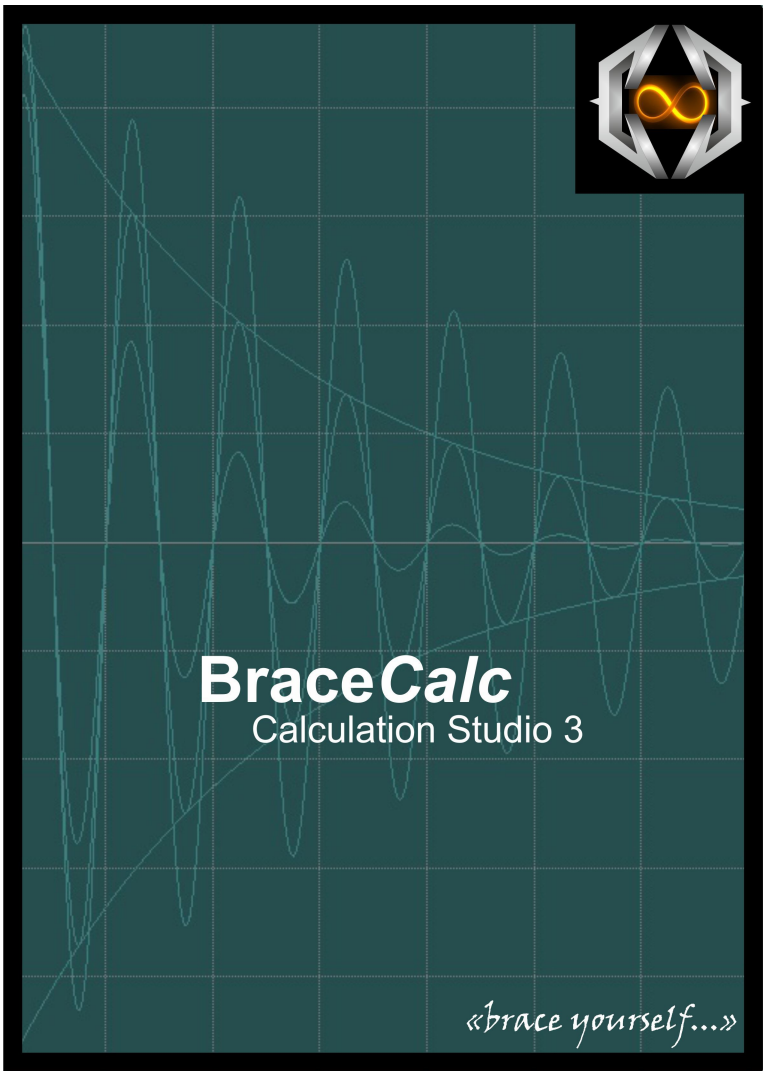
User Manual



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1. Overview

1.1. General

BraceCalc is an independent software for graphical illustrations of mathematical-numerical calculations.
BraceCalc runs with Microsoft Windows (XP, Vista, 7).

Principal constituents :

- Windows Program with TDI (tapped document interface)
- Graphic presentation of curves with zoom and cursor functions
- Definition of functions and function parts
- Mathematical methodes
- Signal analysis
- Analog and digital filters
- Statistic Histogram
- UPN Calculator

1.2. Support

BraceCalc customer support :

Eicher Engineering
Software Development
Frigadenstrasse 23
CH-8739 Rieden SG
Switzerland

www.eichereng.ch
brace@eichereng.ch

1.3. Installation, Uninstallation

BraceCalc doesn't need an install routine.
You can use ***BraceCalc*** directly from a read/write data memory.
Such as harddrive, memory stick, memory card etc.
Please allways copy the entire ***BraceCalc*** folder to the data memory.

BraceCalc couldn't be used directly from a CD. You have to copy the ***BraceCalc*** folder to a read/write data memory.

BraceCalc doesn't need an uninstall routine.
Just delete the entire ***BraceCalc*** folder from your PC.
Attention: ***BraceCalc*** user files (*.bcx) in the ***BraceCalc*** folder wil be lost !

Important:
BraceCalc needs a installed Microsoft .NET framework version 2.0 or newer.
Mostly it is part of the Microsoft Windows and already installed.
It could be necessary to install the .NET framework on older Microsoft Windwos, such as XP.
You can download the .NET framework for free at www.microsoft.com.

1.4. Manufacturer Information

1.4.1. Trademarks

Windows, Windows XP, Windows Vista, Windows 7 are registered trademarks of the Microsoft Corporation.

1.4.2. Copyright

It's not allowed to copy or change part of this software. Please read the licensing agreement.

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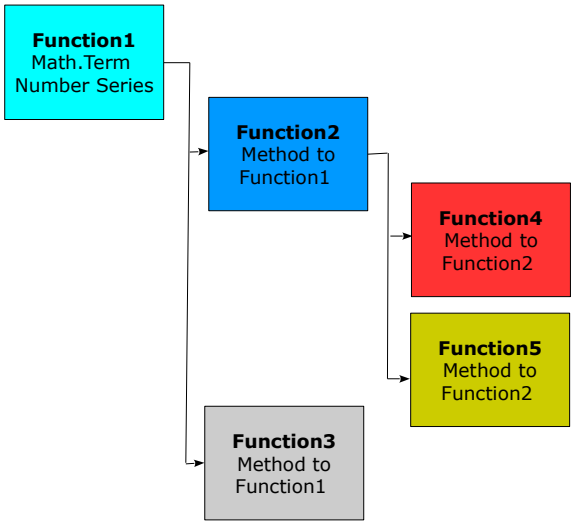
THE SOFTWARE AND DOCUMENTATION ARE PROVIDED 'AS IS.' TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, EICHER ENGINIEERING DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED,
INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT AND FITNESS FOR A PARTICULAR PURPOSE. ANY LIABILITY OF EICHER ENGINEERING WILL BE LIMITED EXCLUSIVELY TO REFUND OF THE PURCHASE PRICE.

2. Implementation

2.1. General

BraceCalc is a software tool for graphic presentations of mathematical calculations and mathematical methods.

A ***BraceCalc*** function 1 can be calculated to a function 2 with a mathematical method.
And also function 2 to function 3 and so on.



A mathematical term is a function string with one or none variable.

y = f(x) e.g. $x - x^2 + 4$, sin(x), 5, etc.

BraceCalc calculates and saves this function string. The result is an array of numbers {x,y}.

A method calculates a new array of numbers with the first array of numbers.

Function1 $\{x_n,y_n\}$ n=0...k —Method→ Function2 $\{x_n, y_n\}$ n=0...k

The operation of the mathematical terms and methods are described with the ***BraceCalc*** script language.

2.2. BraceCalc Script

BraceCalc script allows to describe and define the mathematical terms, methods, types etc. for calculating the functions.

The syntax of ***BraceCalc*** script alikes Typo3 script.
BraceCalc script is more simple and it contains just the functionality you need.

[***BraceCalc*** property] = [value, term, const, name]

- Property groups are separated with a dot '.' or a brace '{'.
- Line comment is a '//'. There is no block comment.
- Consts are always used with a '[]'. That's necessary for recognation.

BraceCalc script works up down. Consts, limits, function parts couldn't be defined in any order. They have to be defined in logical order.

Example:

```
// Parabel with limits
k1 = 0
k2 = 2
F.Term  = x^2
F.Start = [k1]
F.Stop  = [k2]
```

or

```
// Parabel with limits
k1 = sin(0.001)  // 'sin' predefined mathematical function
k2 = [k1] + 3
F
{
   Term  = x^2
   Start = [k1]
   Stop  = [k2]
}
```

F is for function. The allocated properties define it and allow a calculation.
k1 and k2 are consts. They have also allocated properties.

All ***BraceCalc*** scripts are written in the corresponding text window. You can also import a script as a text file.

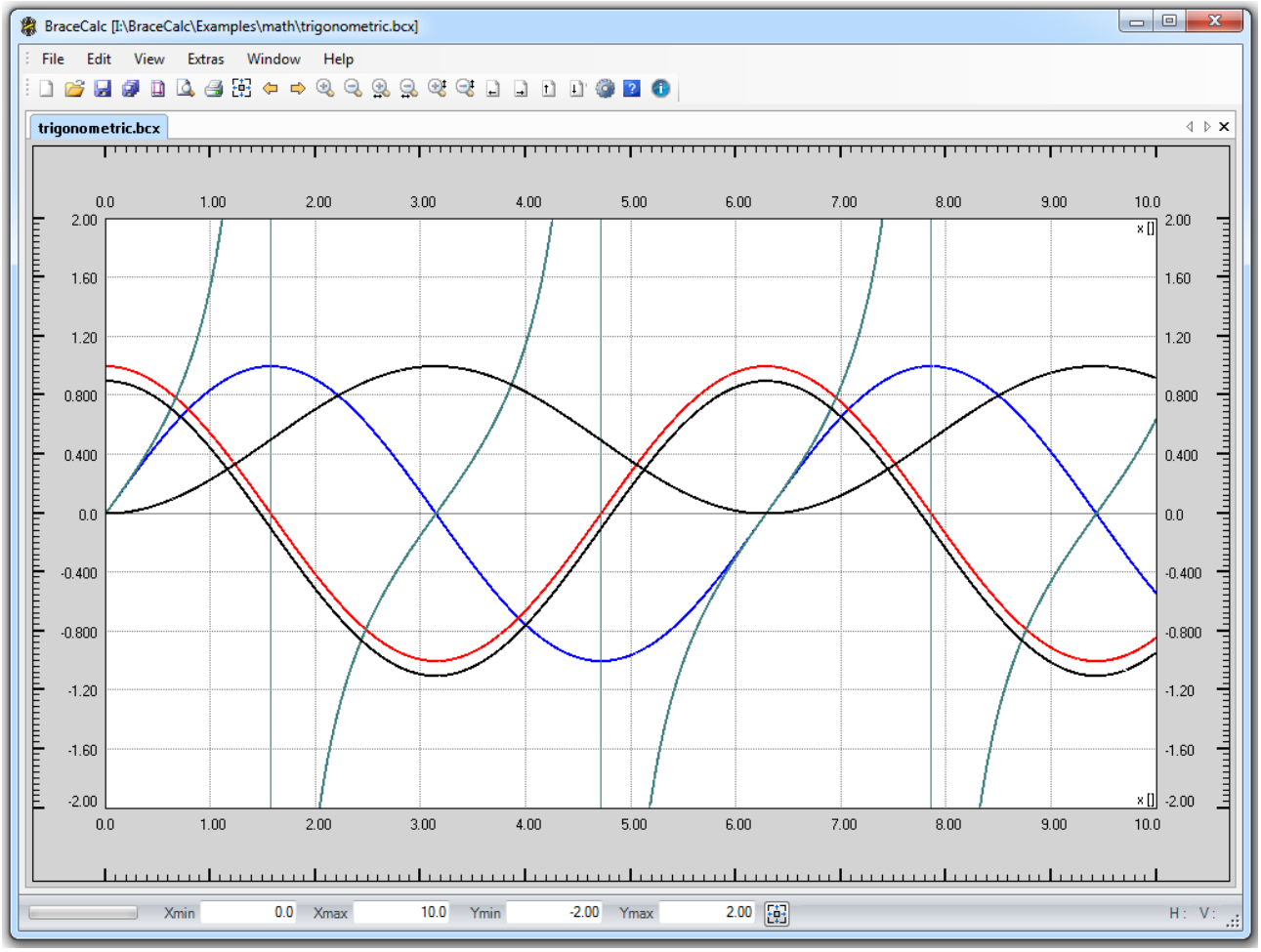
2.3. Functions

The function is the main unit of ***BraceCalc***.
It always contains an array of numbers. This array is pictured as a curve.

This function numbers are the results of a calculation. They can be also a statical array of predefined numbers (e.g. import from Microsoft Excel).

Possible function calculations :

- Mathematical terms for an entire function.
- Mathematical terms for some parts of a function.
- Const calculation
- Method calculations
- Fouriertransformation


BraceCalc [I:\BraceCalc\Examples\math\trigonometric.bcx]
File Edit View Extras Window Help
trigonometric.bcx
0.0 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.0
2.00 1.60 1.20 0.800 0.400 0.0 -0.400 -0.800 -1.20 -1.60 -2.00
Xmin 0.0 Xmax 10.0 Ymin -2.00 Ymax 2.00
H : V :

Scriptelements for functions

```
F.[Scriptelement] = [Allocation]
```

Name	Allocation	Description	Example

Term	Mathematical term with one or none variable, const
	
	Predefined:
	* / + - ^
	sqr, sqrt
	sin, cos, tan, atan
	sinh, cosh, cotan,
	exp, ln, log,
	abs, sign, trunc
		Function term as a string
		f(x), f(t)
			`F.Term = 3 * x^2 + x -5`
			`F.Term = 1.2`
			`F.Term = sin([PI] * 0.1)`

Start	Value	Begin (x1) of the calculation (lower than Stop) The property limits will be valid without a Start definition.	`F.Start = 0`
Stop	Value	Stop (x2) of the calculation (higher than Start) The property limits will be valid without a Stop definition.	`F.Stop = 4.5`
TypeX	UInt8, Int8 UInt16, Int16 UInt32, Int32 UInt64, Int64 Float32, **Float64**	Type definition horiziontal axe (x). loat64 will be valid without a TypeX definition.	`F.TypeX = UInt8`
TypeY	UInt8, Int8 UInt16, Int16 UInt32, Int32 UInt64, Int64 Float32, **Float64**	Type definition vertical axe (y). Float64 will be valid without a TypeY definition.	`F.TypeY = Float32`
Method	ADD SUB MUL DIV AV RMS DIF INT FOURIER RC RLC AM FM PWM ADC PID FILTER	Mathematical methods for calculating output functions.	`F.Method = RMS`

Element1	Shortname of a BraceCalc element	Defined element 1 (digital filter) for the PID-control and filter methods.	`F.Element1 = mybessel03`
Element2	Shortname of a BraceCalc element	Defined element 2 (digital filter) for PID-control and filter methods.	`F.Element2 = mycheby`
Func1	Shortname of a BraceCalc function	Function 1, input function for methods.	`F.Func1 = mysinus`
Func2	Shortname of a BraceCalc function.	Function 2, input function for methods.	`F.Func1 = mypower`
Gain	Gain	Gain factor for methods.	`F.Gain = 3.33`
Offset	Offset	Offset value for methods.	`F.Offset = -10`
Max	Maximum duty cycle	Maximum duty cycle [per mill], for FM, AM, PWM methods.	`F.Max = 500`
Frequency	Frequency	Carrier frequency, for FM, AM, PWM methods.	`F.Frequency = 10000`
Buffer	Buffer	Buffersize, for AV method.	`F.Buffer = 100`
Index1	Fourierindex1	Index1, for Fourier series method.	`F.Index1 = 1`
Index2	Fourierindex2	Index2, for Fourier series method.	`F.Index2 = 100`
Bits	Number of bits	Bitwidth of the ADC sampling	`F.Bits = 12`
R	Resistor	Resistor value, for RC and RLC methods.	`F.R = 1000`
L	Impedance	Impedance value, for RLC method.	`F.L = 0.001`
C	Capacity	Capacity value, for RC and RLC methods.	`F.C = 1E-6`
P	Proportional part	P-part, for PID control method.	`F.P = 5`
I	Integrationl part	I-part, for PID control method.	`F.I = 20`
D	Differential part	D-part, for PID control method.	`F.D = 0.2`
Sampling	Sampling rate	Sampling rate, for PID control method.	`F.Sampling = 1000`
Repeat	Repetition	Repetition of the function Y-Values.	`F.Repeat = 5`

Scriptelements for function parts

```
F.Part.[n].[Scriptelement] = [Allocation]
```

Name	Allocation	Description	Example

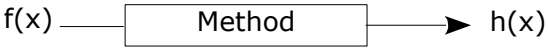
Term	Mathematical term with one or none variable, const
	
	Predefined:
	* / + - ^
	sqr, sqrt
	sin, cos, tan, atan
	sinh, cosh, cotan,
	exp, ln, log,
	abs, sign, trunc
		Function term as a string f(x), f(t)	`F.Part.1.Term = 3 * x^2`
			`F.Part.2.Term = 1.2`
			`F.Part.3.Term = sin(0.1)`

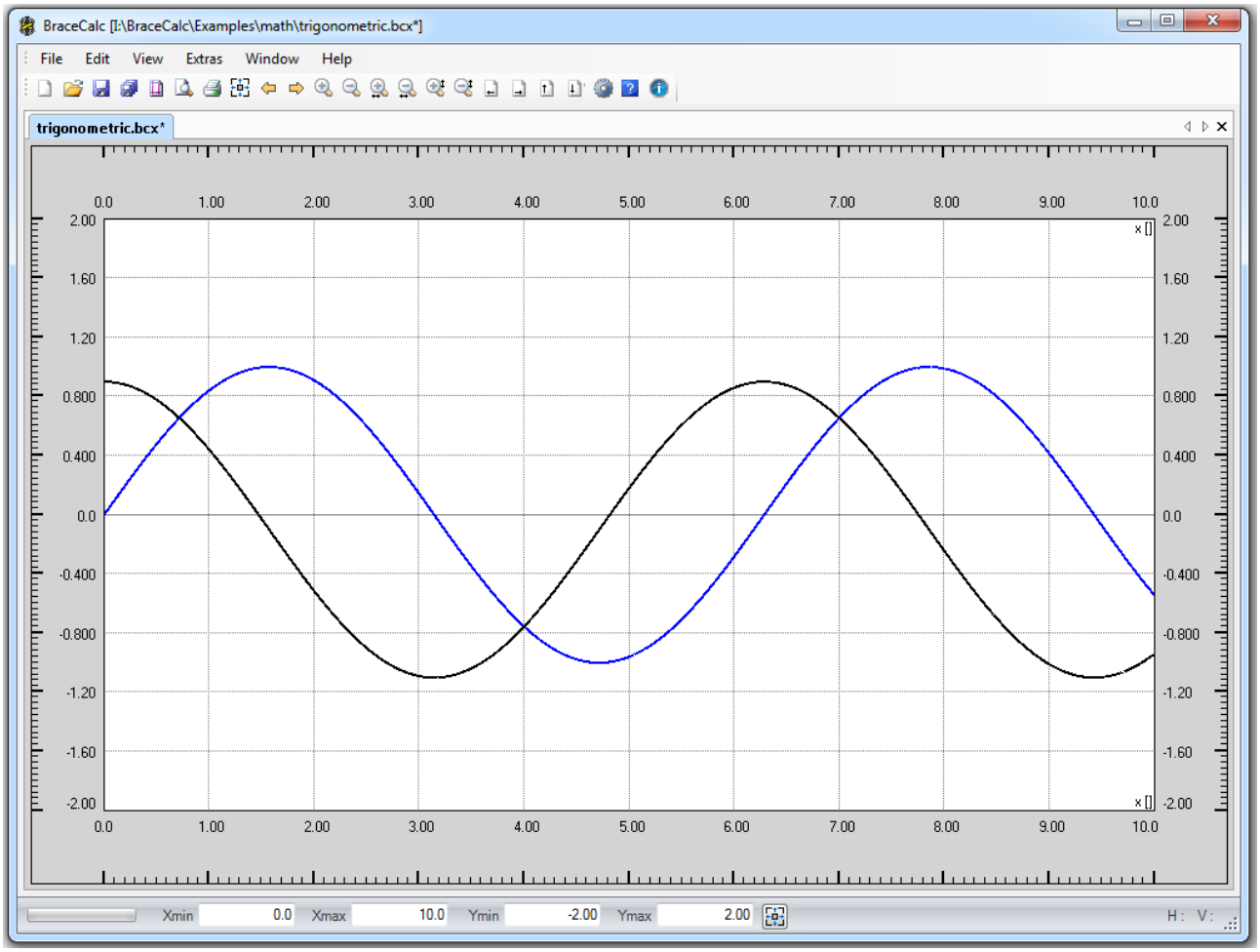
Start	Value	Begin (x1) of the calculation (lower than Stop)	`F.Part.1.Start = 0`
			`F.Part.2.Start = 3`
			`F.Part.3.Start = 5`

Stop	Value	Stop (x2) of the calculation (higher than Start)
		
		Just the last function part needs a Stop element.
			`F.Part.1.Stop = 3`
			`F.Part.2.Stop = 5`
			`F.Part.3.Stop = 8`

2.4. Methods

The Methods are the heart of ***BraceCalc***.
A methode uses a input function A and ***BraceCalc*** calculates the output function B.
Function B can also be used as a input function for a next method calculation.
This allows a singal analysis with any grading.




BraceCalc [I:\BraceCalc\Examples\math\trigonometric.bcx*]
File Edit View Extras Window Help
trigonometric.bcx*
0.0 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.0
2.00 1.60 1.20 0.800 0.400 0.0 -0.400 -0.800 -1.20 -1.60 -2.00
Xmin 0.0 Xmax 10.0 Ymin -2.00 Ymax 2.00
H: V:

Example:
Sinus curve as input function (blue). The method DIF (differential) calculates the first derivation as an output function (black).

Method	Parameter, Scriptelements	Description	Example

LIN	Func1
	Gain
	Offset
	Start optional
	Stop optional
	TypeY optional
		Function with gain and offset
		$h(x)=f(x)\cdot gain+offset$
		f(x) = input function 1
			`F.Method = LIN`
			`F.Func1 = myfunc1`
			`F.Gain = -2.5`
			`F.Offset = 99`

ADD	Func1
	Func2
	Start optional
	Stop optional
	Gain optional
	Offset optional
	TypeY optional
		Addition of two input functions.
		$h(x)=f(x)+g(x)$
		f(x) = input function 1
		g(x) = input function 2
			`F.Method = ADD`
			`F.Func1 = myfunc1`
			`F.Func2 = myfunc2`

SUB	Func1
	Func2
	Start optional
	Stop optional
	Gain optional
	Offset optional
	TypeY optional
		Subtracts input function 2 of input function 1.
		$h(x)=f(x)-g(x)$
		f(x) = input function 1
		g(x) = input function 2
			`F.Method = SUB`
			`F.Func1 = myfunc1`
			`F.Func2 = myfunc2`

MUL	Func1
	Func2
	Start optional
	Stop optional
	Gain optional
	Offset optional
	TypeY optional
		Multiplies input function 1 by input function 2.
		$h(x)=f(x)\cdot g(x)$
		f(x) = input function 1
		g(x) = input function 2
			`F.Method = MUL`
			`F.Func1 = myfunc1`
			`F.Func2 = myfunc2`

DIV	Func1
	Func2
	Start optional
	Stop optional
	Gain optional
	Offset optional
	TypeY optional
		Divides input function 2 by input function 1.
		$h(x)=\frac{f(x)}{g(x)}$
		f(x) = input function 1
		g(x) = input function 2
			`F.Method = DIV`
			`F.Func1 = myfunc1`
			`F.Func2 = myfunc2`

AMP	Func1
	Func2
	Start optional
	Stop optional
	Gain optional
	Offset optional
	TypeY optional
		Function 1 uses Function 2 as a gain characteristic curve
		$h(x)=f(x)\cdot g(f(x))$
		Func1 = input function 1
		Func2 = input function 2
			`F.Method = AMP`
			`F.Func1 = myfunc1`
			`F.Func2 = myfunc2`

AV	Func1
	Buffer optional
	Start optional
	Stop optional
	Gain optional
	Offset optional
	TypeY optional
		Average value of input function 1.
		$h_{av}=\frac{1}{N}\sum_{x=1}^{N} f(x)$
		f(x) = input function 1
		Static average calculation over the entire function without any buffer declaration.
		Dynamic average calculation with a buffer declaration.
		Buffer = 10 means an average calculation over 10 per mill steps.
			`F.Method = AV`
			`F.Func1 = myfunc`
			`F.Buffer = 10`

RMS	Func1 Start optional Stop optional Gain optional Offset optional TypeY optional	RMS (root mean square) of input function 1. $h_{rms}=\sqrt{\frac{1}{N}\sum_{x=1}^{N} f(x)^2}$ f(x) = input function 1	`F.Method = RMS` `F.Func1 = myfunc`
DIF	Func1 Start optional Stop optional Gain optional Offset optional TypeY optional	First derivation of input function 1. $h(x)=\frac{f(x)}{dx}$ f(x) = input function 1 The input function limits are valid without any Start and Stopp declaration.	`F.Method = DIF` `F.Func1 = myfunc`
INT	Func1 Start optional Stop optional Gain optional Offset optional TypeY optional	Integral of input function 1. $h(x)=\int f(x)dx$ f(x) = input function 1 The input function limits are valid without any Start and Stopp declaration.	`F.Method = INT` `F.Func1 = myfunc`

FOURIER	Func1
	Index1
	Index2
		Fourier series of input function 1.
		$h(x)=\frac{a_0}{2}+\sum_{k_1}^{k_2} a_k\cos(kx)+b_k\sin(kx)$
		Func1 = input function 1
			`F.Method = FOURIER`
			`F.Func1 = myfunc`
			`F.Index1 = 1`
			`F.Index2 = 50`

RC	Func1
	R
	C
	Start optional
	Stop optional
	Gain optional
	Offset optional
		Filtration of input function 1 with a RC circuit.
		f(x) — RC → h(x)
		f(x) = input function 1
		R = Resitor
		C = Capacity
			`F.Method = RC`
			`F.Func1 = myfunc`
			`F.R = 1000`
			`F.C = 1E-6`

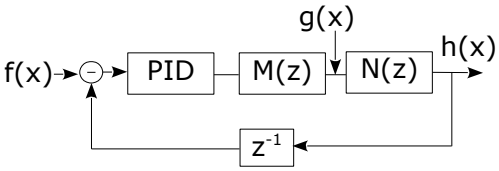
RLC	Func1
	R
	L
	C
	Start optional
	Stop optional
	Gain optional
	Offset optional
		Filtration of input function 1 with a RLC circuiot.
		f(x) — RLC → h(x)
		f(x) = input function 1
		R = Resitor
		L = Impedance
		C = Capacity
			`F.Method = RLC`
			`F.Func1 = myfunc`
			`F.R = 1000`
			`F.L = 0.001`
			`F.C = 1E-6`

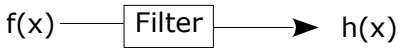
AM	Func1
	Frequency
	Max
	Start optional
	Stop optional
	Gain optional
	Offset optional
		Amplitude modulation of input function 1.
		f(x) — AM → h(x)
		f(x) = input function 1
		Frequency = carrier frequency
		Max = maximum duty cycle [per mill]
			`F.Method = AM`
			`F.Func1 = myfunc`
			`F.Frequency = 10000`
			`F.Max = 900`

FM	Func1
	Frequency
	Max
	Start optional
	Stop optional
	Gain optional
	Offset optional
		Frequecy modulation of input function 1.
		f(x) — FM → h(x)
		f(x) = input function 1
		Frequency = carrier frequency
		Max = maximum duty cycle [per mill]
			`F.Method = FM`
			`F.Func1 = myfunc`
			`F.Frequency = 10000`
			`F.Max = 900`

PWM	Func1
	Frequency
	Max
	Start optional
	Stop optional
	Gain optional
	Offset optional
		Pulse wide modulation of input function 1.
		f(x) — PWM → h(x)
		f(x) = input function 1
		Frequency = carrier frequency
		Max = maximum duty cycle [per mill]
			`F.Method = PWM`
			`F.Func1 = myfunc`
			`F.Frequency = 10000`
			`F.Max = 900`

ADC	Func1
	Frequency
	Bits
	Max
	Start optional
	Stop optional
		Analog-Digital conversion of input function 1.
		
		f(x) = input function 1
		Frequency = sampling frequency
		Bits = bit width resolution
		Max = maximum input value
			`F.Method = ADC`
			`F.Func1 = myfunc`
			`F.Frequency = 10000`
			`F.Max = 3`

PID	Func1
	Func2 optional
	Element1 optional
	Element2 optional
	Sampling optional
	P
	I
	D
	Max
	Start optional
	Stop optional
	Gain optional
	Offset optional
		PID control with input function 1 and input function 2.
		 
		f(x) = set function
		g(x) = disturbance function
		Element1 = digital transfer function 1 (filter)
		Element2 = digital transfer function 2 (filter)
		Sampling = sampling frequency
		P = proportional parameter
		I = integral parameter
		D = differential parameter
		Max = maximum control duty cycle
			`F.Method = PID`
			`F.Func1 = mySoll`
			`F.Func2 = myDisturb`
			`F.Element1 = myBess1`
			`F.Element2 = myBess2`
			`F.P = 0.1`
			`F.I = 54`
			`F.D = 0.3`
			`F.Max = 1000`
			`F.Sampling = 1000`

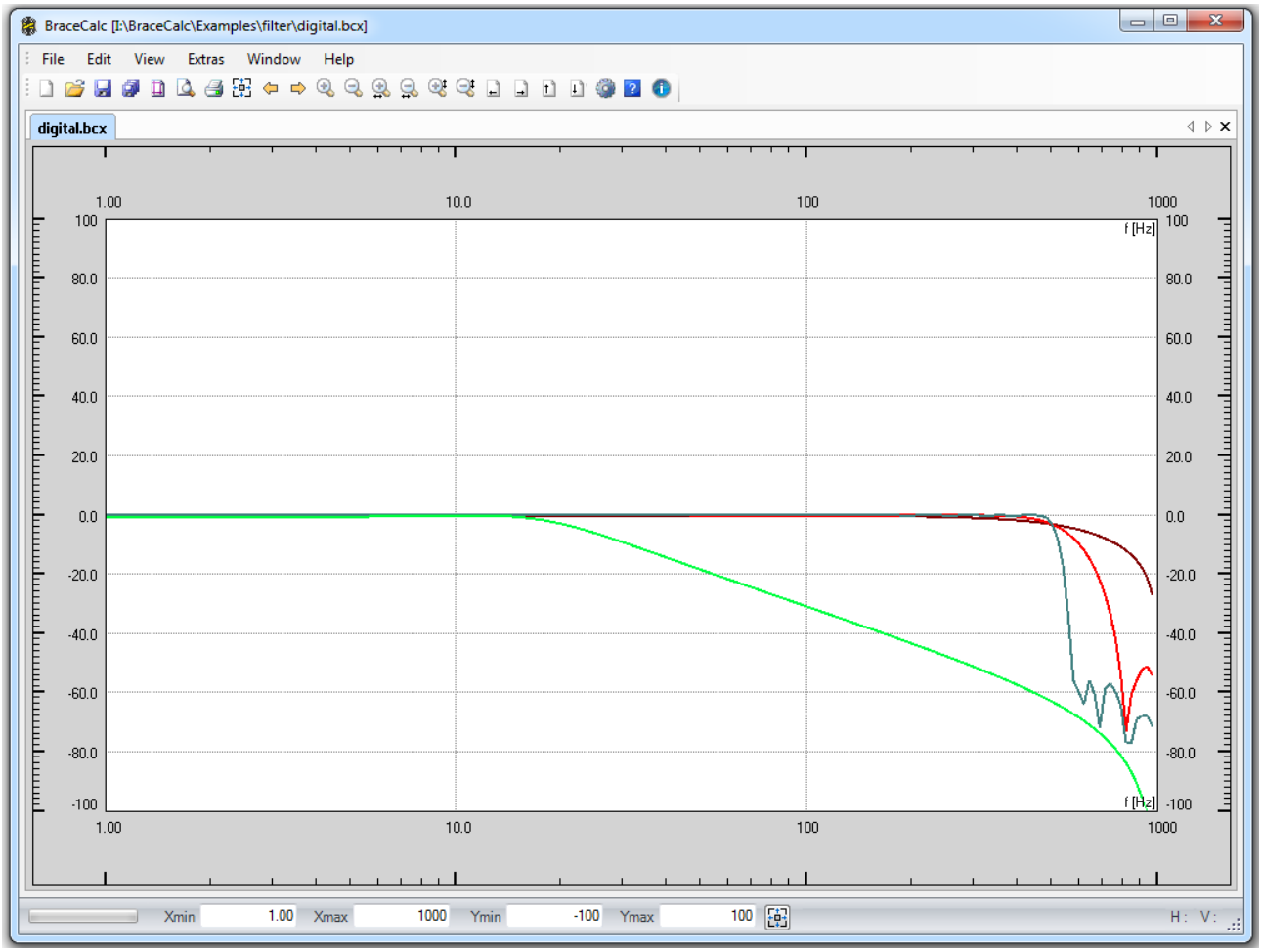
FILTER	Func1
	Element1
	Sampling optional
	Start optional
	Stop optional
	Gain optional
	Offset optional
		Filtration of input function 1.
		 
		f(x) = input function 1
		Element1 = digital transfer function (filter)
		Sampling = sampling frequency
			`F.Method = FILTER`
			`F.Element1 = myCheby`
			`F.Func1 = myfunc`

2.5. Filter

BraceCalc allows to define analog and digital filters with Bode and Phase curves.

These elements are independent from the function definition.
They also can display in the main view and can print out.

The definition again happens with ***BraceCalc*** script and the element allocations.



You use digital filter elements for the FILTER method in the function calculation.

Definitions:

$$P = j\frac{\omega}{\omega_g} \; bzw. \; j\frac{f}{f_g}$$

$$\Delta\Omega = Bandbreite$$

General transfer function

$$A(P) = \frac{A_0 + A_1 P + \ldots A_n P^n}{B_0 + B_1 P + \ldots B_m P^m}$$

Analog lowpass filter

$$A(P) = \frac{A_0}{\prod_i 1 + a_i P + b_i P^2}$$

Analog highpass filter

$$A(P) = \frac{A_\infty}{\prod_i 1 + \frac{a_i}{P} + \frac{b_i}{P^2}}$$

Analog bandpass filter

$$A(P) = \frac{A_0}{\prod_i 1 + a_i \frac{P + \frac{1}{P}}{\Delta\Omega} + b_i \left(\frac{P + \frac{1}{P}}{\Delta\Omega}\right)^2}$$

Analoge bandstop filter

$$A(P) = \frac{A_\infty}{\prod_i 1 + a_i \frac{\Delta\Omega}{P + \frac{1}{P}} + b_i \left(\frac{\Delta\Omega}{P + \frac{1}{P}}\right)^2}$$

Digital FIR and IIR filter

$$A(z) = \frac{Y(z)}{X(z)} = \frac{\sum_{k=0}^{N} \alpha_k z^{-k}}{1 + \sum_{k=1}^{N} \beta_k z^{-k}}$$

Scriptelements for filters

```
Filter.[Scriptelement] = [Allocation]
```

Name	Allocation	Description	Example
Form	POLYNOM LOWPASS HIGHPASS BANDPASS BANDSTOP DIGITAL	Filter types.	`Filter.Form = LOWPASS`
TypeX	UInt8, Int8 UInt16, Int16 UInt32, Int32 UInt64, Int64 Float32, **Float64**	Type definition horiziontal axe (frequency). loat64 will be valid without a TypeX definition.	`Filter.TypeX = UInt8`
TypeY	UInt8, Int8 UInt16, Int16 UInt32, Int32 UInt64, Int64 Float32, **Float64**	Type definition vertical axe (gain). loat64 will be valid without a TypeX definition.	`Filter.TypeY = Float32`
Gain	Gain	Gain factor of the entire transfer function.	`Filter.Gain = 100`
Threshold	Threshold frequency	Cut off frequency with normed calculation.	`Filter.Threshold = 1000`
Band	Bandwidth	Bandwith for bandpass and bandstop filters	`Filter.Band = 10`
Sampling	Sampling frequency	Sampling frequency for digital filters.	`Filter.Sampling = 10000`

A[k]	A coefficients
	α coefficients
		Coefficients array 0..N	`Filter.A.0 = 1`
			`Filter.A.1 = 0.1`
			`Filter.A.2 = 1.5`

B[k]	B coefficients
	β coefficients
		Coefficients array 0..N	`Filter.B.0 = 1`
			`Filter.B.1 = 0.1`
			`Filter.B.2 = 1.4`
			`Filter.B.3 = 2.3`
			`Filter.B.4 = 0.9`

2.6. Statistics

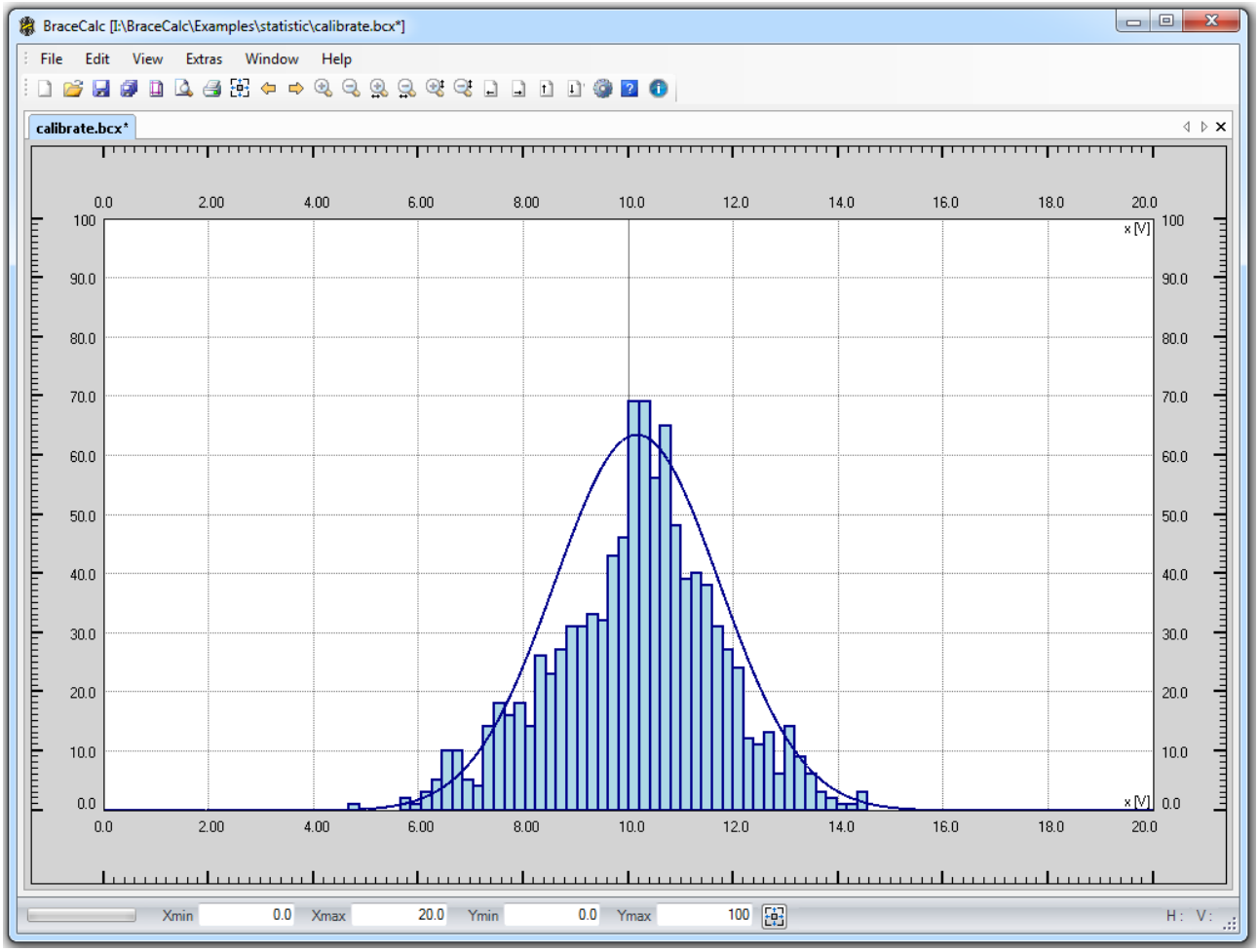
BraceCalc statistic elements allows you to illustrate values and numbers in hystograms and Gauss bell shaped curves.

BraceCalc calculates with value arrays and classes

- Numbers of values
- Minimum
- Maximum
- Average value
- Standard deviation

The Gauss bell shaped curve is :

$$f(x)=\frac{1}{\sqrt{2\pi\sigma}}e^{-\frac{1}{2}\frac{(x-a)^2}{\sigma^2}}$$


BraceCalc [I:\BraceCalc\Examples\statistic\calibrate.bcx*]
File Edit View Extras Window Help
calibrate.bcx*
0.0 2.00 4.00 6.00 8.00 10.0 12.0 14.0 16.0 18.0 20.0
100 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 0.0
x [V]
Xmin 0.0 Xmax 20.0 Ymin 0.0 Ymax 100
H : V :

Scriptelements for statistics

```
Stat.[Scriptelement] = [Allocation]
```

Bezeichnung	Zuweisung	Beschreibung	Beispiel
N	Class width	Class width of the hystogram.	`Stat.N = 10`

V	Value	Single value of the statistic	`Stat.V = 123.456`
			`Stat.V = 145.34`
			`Stat.V = 112.89`

Gain	Gain	Multiply the Gauss curve with this factor.	`Stat.Gain = 10`
Offset	Offset	Adds this value to the Gaus curve.	`Stat.Offset = 1`

You can also import values from an external file (e.g. Csv).

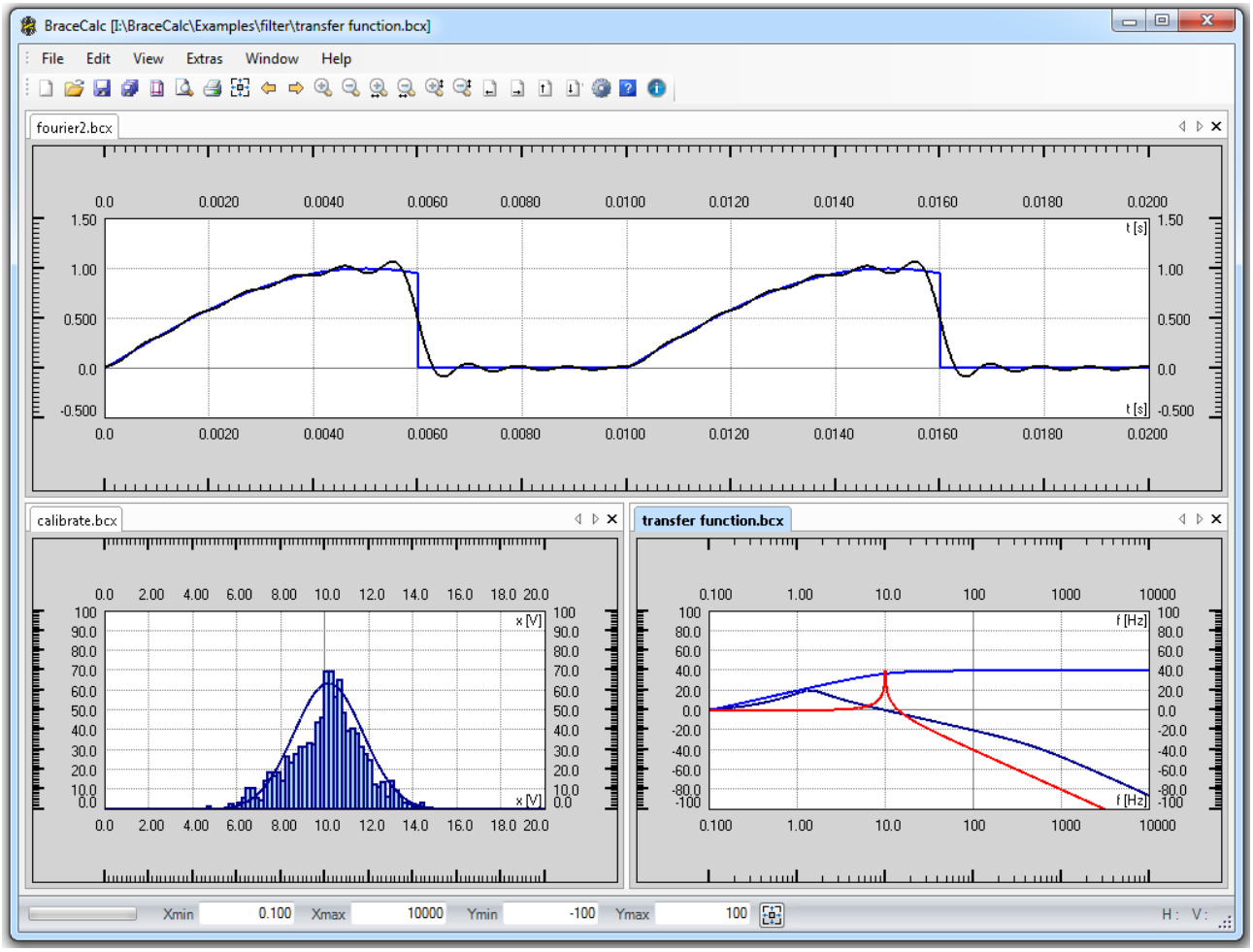
3. References

3.1. Main window and files

The ***BraceCalc*** main window contains a TDI (tabbed document interface).
You can open and place any documents with tabs. The tabs are free for placing.

The coordinate display applies to the actual focused file.The ***BraceCalc*** files *.bcx are based on the XML-format with there own TAGs.

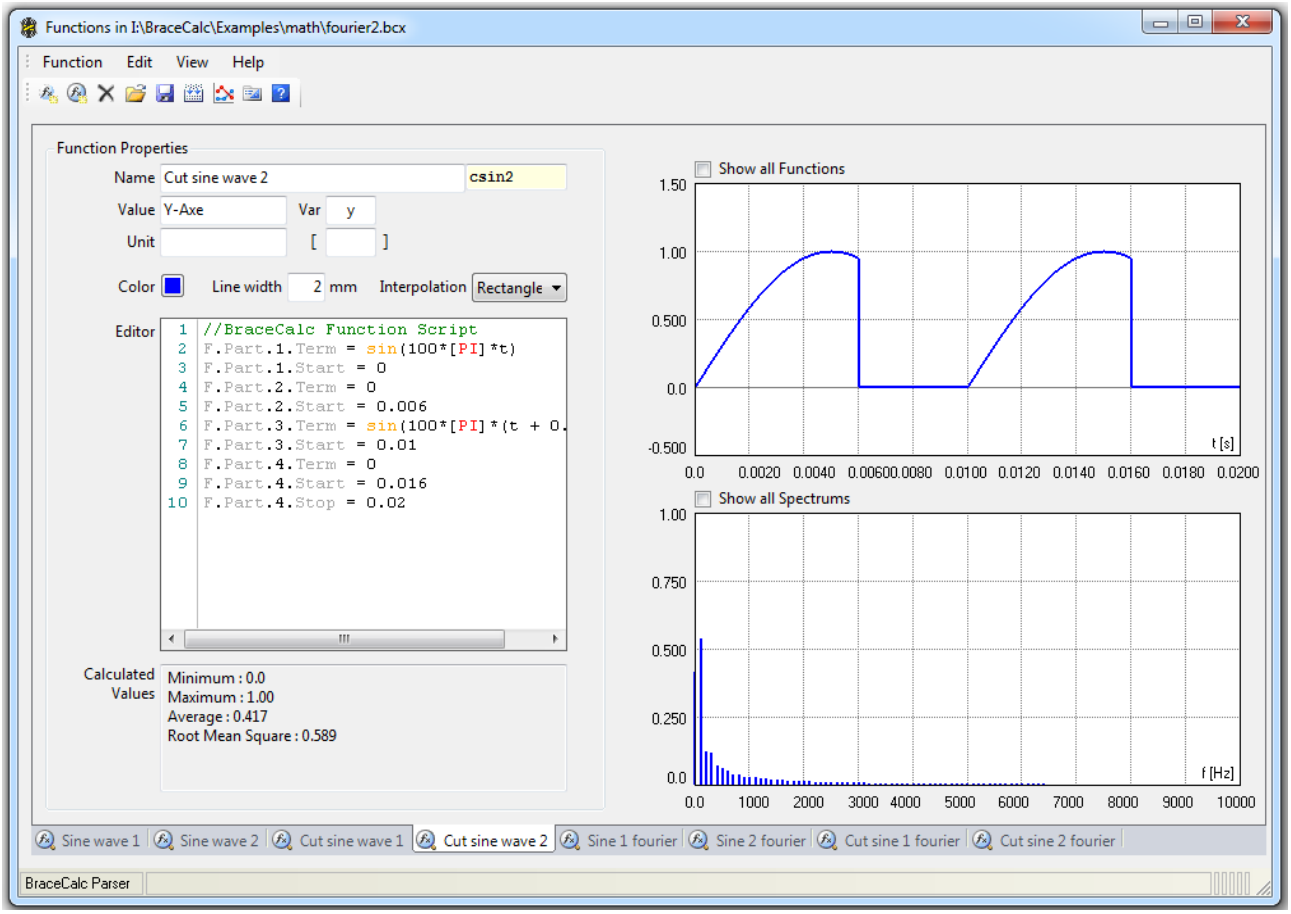
Attention:
Pleas don't change any *.bcx file directly in a text editor or similar.
The file can become useless and the data will be lost.



3.2. Functions

The ***BraceCalc*** functions are defined in the function dialog.

<Edit><Functions> or
Keys <Strg+T> or
Right Mouse button <Functions>



A ***BraceCalc*** function will be defined with ***BraceCalc*** script.
XY view and frequency view can display.

The resolution depends on the number of steps for XY and frequency view.

3.2.1. Parameter

- Name — Name of the function, for information.
  You can use spaces, special characters etc.
- Shortname — Shortname of the function.
  Important: This name musn't include any spaces and special characters. It serves as function recognition in the method calculation.
- Var — X axe variable
- Unit — X axe unit
- Color — Color of the curve
- Line width — Width of the curve
- Interpolation — Interpolation between two calculated points.
  Linear: Direct line between both points.
  Rectangle: Vertical and horizontal line between both points.
- Script window — Text window for edit function scripts.
- Calculated values — Calculated values: Minimum, maximum, mean values, RMS value.
- Graphic window — Coordinate system with the calculated curve.

3.2.2. General Properties

- Horizontal, X axe — Variable, Unit, Minimum, Maximum
  Scale linear or logarithmic
- Vertical, Y axe — Variable, Unit, Minimum, Maximum
  Scale linear or logarithmic
- Background — Background color

3.2.3. Frequency spectrum Properties

- Horizontal — Variable, Unit, Minimum, Maximum
- Vertical — Variable, Unit, Minimum, Maximum

3.2.4. Base lines

- Base lines — Color, pattern, line width
- Horizontal — Base value, view
- Vertical — Base value, view

3.2.5. Grid

- Grid — Color, pattern, line width
- Horizontal — Division, view
- Vertical — Division, view

3.2.6. Create, Copy, Delete

<Function><Add New Function>
A new function will be added in a new tab.
The function script contains the ***BraceCalc*** standard function.
BraceCalc chooses name, shortname, color, line width and interpolation.
Unit and value won't be definied.

<Function><Copy Selected Function>
A copy of the selected function will be added in a new tab.
BraceCalc changes name and shortname to aviod ambiguous problems.

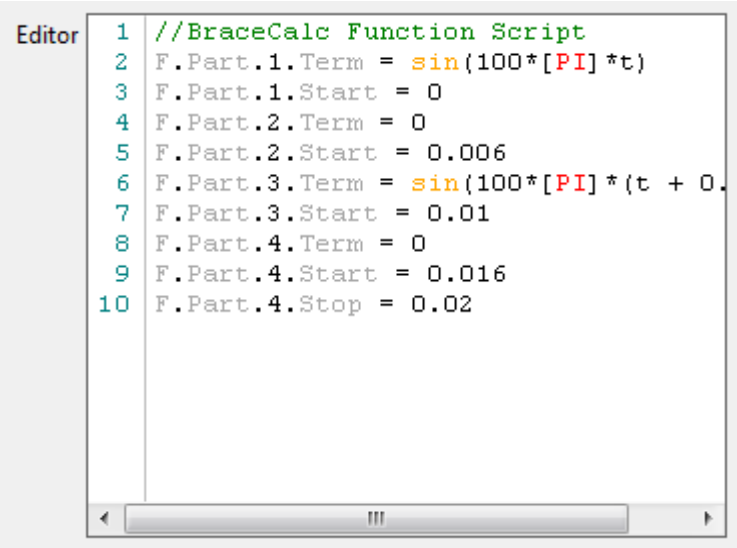
Important:
The function shortname has to be clear in the document.

<Function><Delete Selected Function>
The selected function will be deleted.

Important:
There's an error if a deleted function is used in a method. Because the method needs this functions which won't exist after deleting.

3.2.7. Create and Edit Script

You can edit the***BraceCalc*** scripts in the edit window of the function dialog.



Script key words, mathematic functions, methods, constants and comments are highlighted.

3.2.8. Parse and Calculate

<Edit><Parse and Calculate> or Key<F5>
It's necessary to parse and calculate the functions after changing.

All function scripts of the document will be reading and parsing.
All dependencies will be determining and prioritizing between the functions.

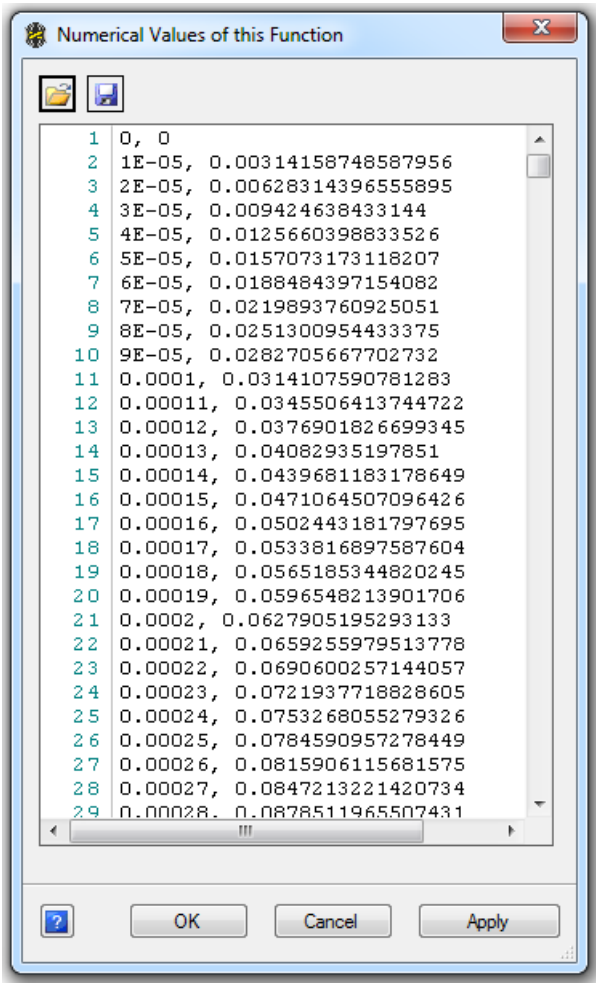
After that all functions will be calculated and displayed.

3.2.9. Numerical Values

<Edt Numerical Values>

The calculated value array can be changed.

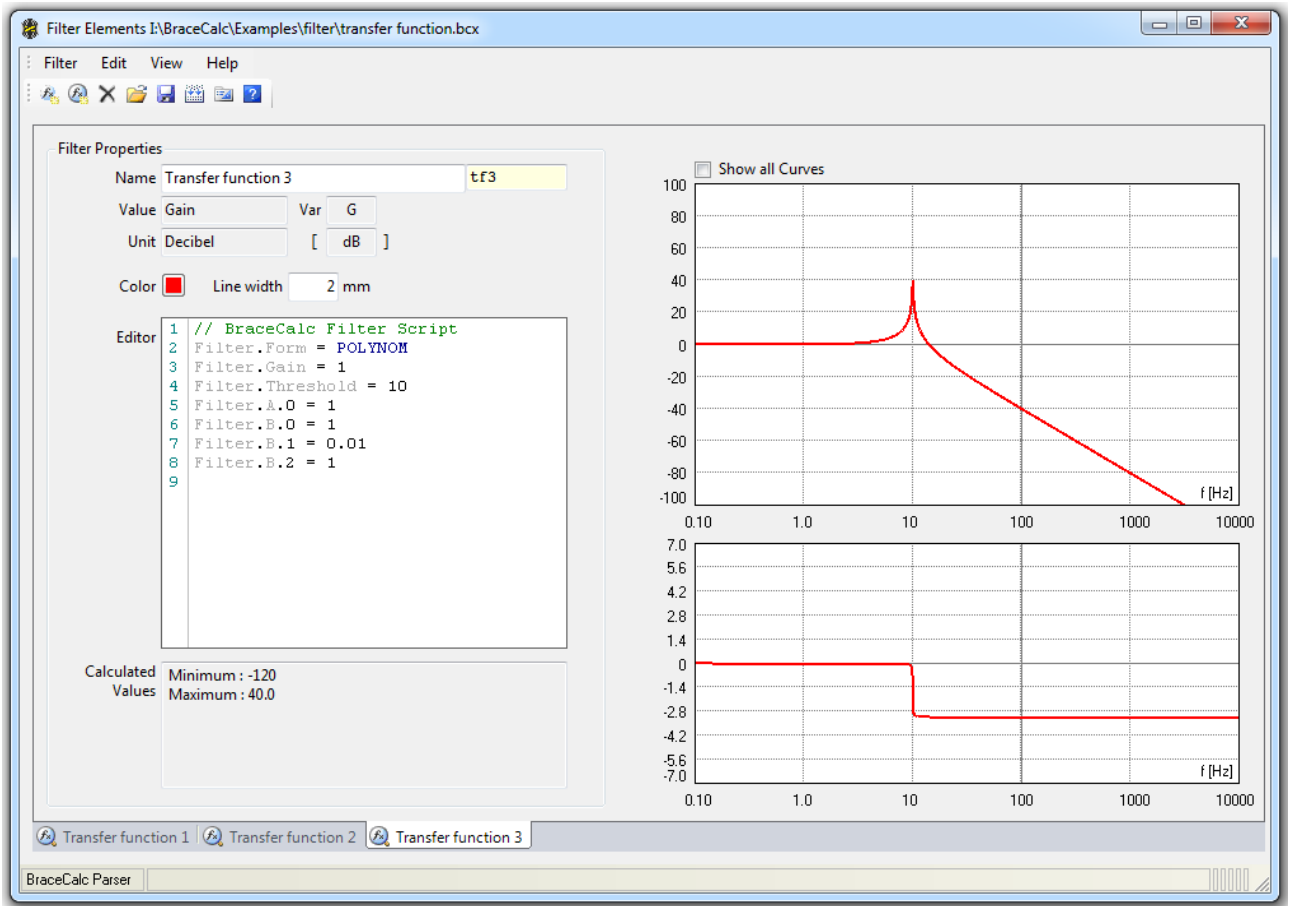
If you change any values manually ***BraceCalc*** saves the entire function values array staticly.
The function script becomes ineffective.



3.3. Filter and Transfer Functions

The ***BraceCalc*** filter elements are defined in the filter dialog.

<Edit><Filter...>


Filter Elements I:\BraceCalc\Examples\filter\transfer function.bcx
Filter Edit View Help
Filter Properties
Name Transfer function 3 tf3
Value Gain Var G
Unit Decibel [dB]
Color Line width 2 mm
Editor
1 // BraceCalc Filter Script
2 Filter.Form = POLYNOM
3 Filter.Gain = 1
4 Filter.Threshold = 10
5 Filter.A.0 = 1
6 Filter.B.0 = 1
7 Filter.B.1 = 0.01
8 Filter.B.2 = 1
9
Calculated Values
Minimum : -120
Maximum : 40.0
Show all Curves
100 80 60 40 20 0 -20 -40 -60 -80 -100
f [Hz]
0.10 1.0 10 100 1000 10000
7.0 5.6 4.2 2.8 1.4 0 -1.4 -2.8 -4.2 -5.6 -7.0
f [Hz]
0.10 1.0 10 100 1000 10000
Transfer function 1
Transfer function 2
Transfer function 3
BraceCalc Parser

A ***BraceCalc*** filter element is defined with ***BraceCalc*** Script.
You define the coefficients of the different types of transfer functions.

The view is the Bode diagram and the Phase diagram of the transfer function.

The curve resolution depends of the calculation steps.

3.3.1. Parameter

- Name — Name of the transfer function, for information. You can use spaces, special characters etc.
- Shortname — Shortname of the function. **Important**: This name musn't include any spaces and special characters. It serves as function recognition in the method calculation.
- Var — X axe variable
- Unit — X axe unit
- Color — Color of the curve
- Line width — Width of the curve
- Script window — Text window for edit function scripts.
- Calculated values — Calculated values: Minimum, maximum.
- Graphic window — Coordinate system with the calculated curve.

3.3.2. General Properties

- Horizontal, X axe — Variable, Unit, Minimum, Maximum
  Logarithmic scale is given.
- Vertical, Y axe — Variable, Unit, Minimum, Maximum
  Linear scale is given.
- Background — Background color

3.3.3. Phase curve Properties

- Horizontal — Variable, Unit, Minimum (> 0), Maximum (> 0)
  Logarithmic scale is given.
- Vertical — Variable, Unit, Minimum, Maximum
  Linear scale is given.

3.3.4. Base lines

- Base lines — Color, pattern, line width
- Horizontal — Base value, view
- Vertical — Base value, view

3.3.5. Grid

- Grid — Color, pattern, line width
- Horizontal — Division, view
- Vertical — Division, view

3.3.6. Create, Copy, Delete

<Filter><Add New Filter>
A new filter will be added with a new tab.
The filter script contains the ***BraceCalc*** standard filter.
BraceCalc chooses name, shortname, color and line width.

<Filter><Copy Selected Filter>
A copy of the selected filter will be added with a new tab.
BraceCalc changes name and shortname to avoid ambiguous problems.

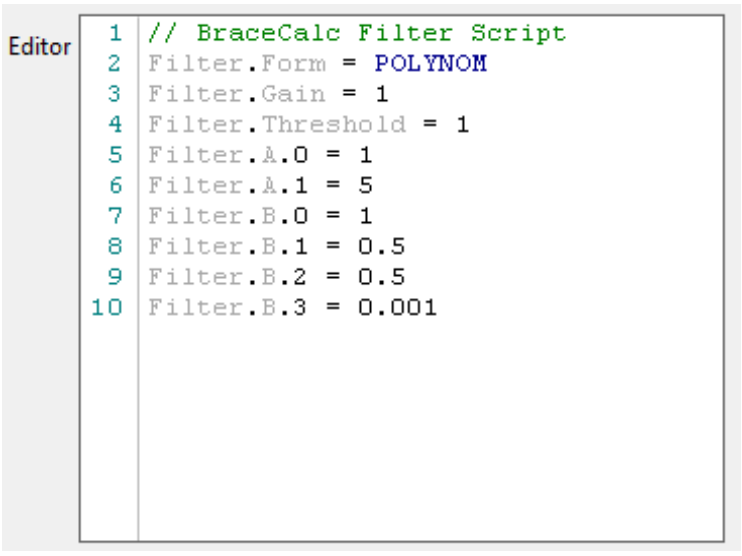
Important:
The filter shortname has to be clear in the document.

<Filter><Delete Selected Filter>
The selected filter will be deleted.

Important:
There's an error if a deleted filter is used in a method. Because the method needs this filter which won't exist after deleting.

3.3.7. Create and Edit Scripts

You can edit the ***BraceCalc*** filter scripts in the edit window of the filter dialog.



The script key words are highlighted.

3.3.8. Parse and Calculate

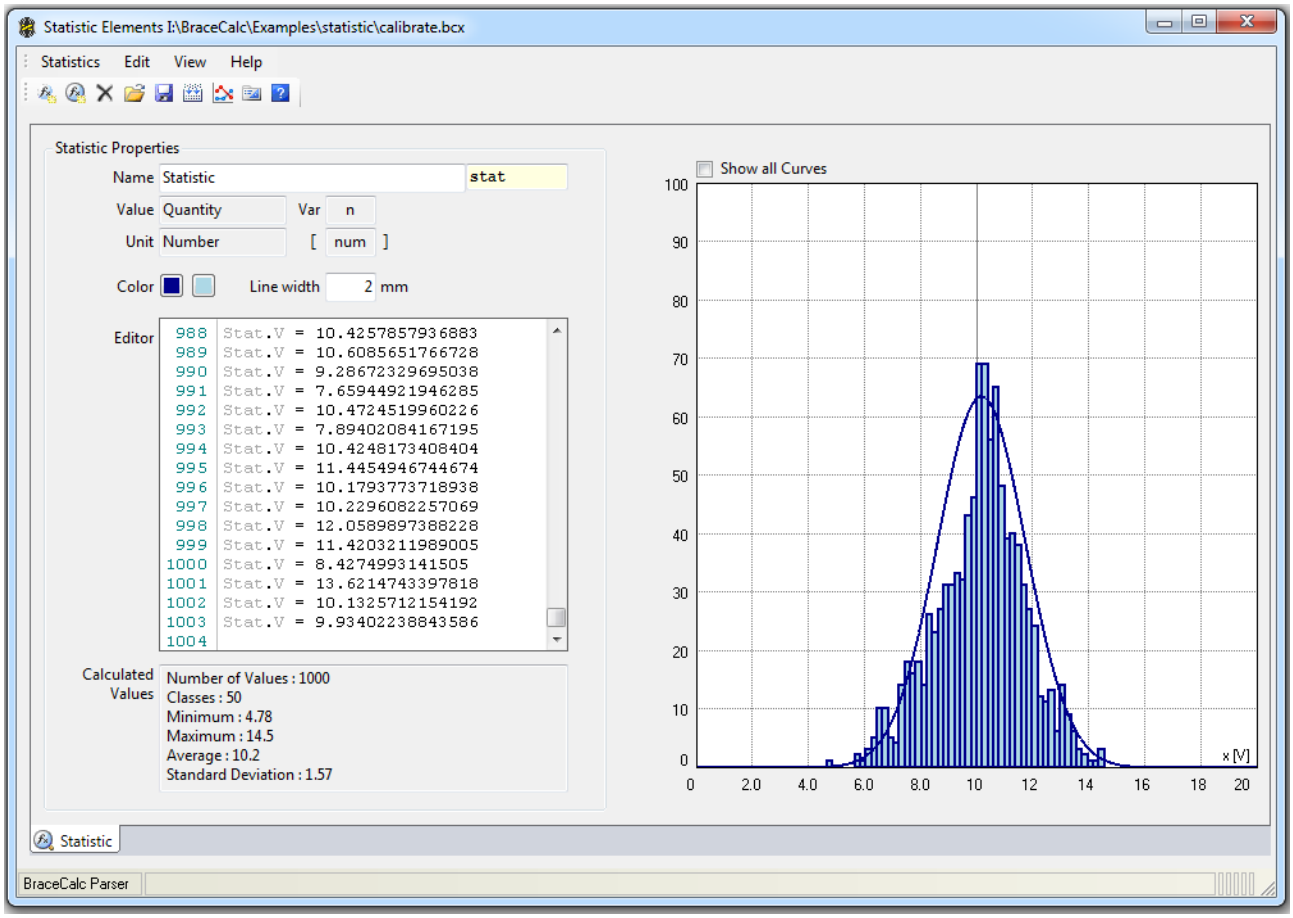
<Edit><Parse and Calculate> or Key<F5>
It's necessary to parse and calculate the filters after changing.

All filter scripts of the document will be reading and parsing.
After that all filters will be calculated and displayed.

3.4. Statistics

The ***BraceCalc*** statistic elements are defined in the statistic dialog.

<Edit><Statistic...>



A ***BraceCalc*** statistic element is defined with ***BraceCalc*** Script.
You define the coefficients and values of the statistic.

The view is the Hystogram and the Gaus curve.

3.4.1. Parameter

- Name — Name of the statistic, for information.
  You can use spaces, special characters etc.
- Shortname — Shortname of the statistic.
  Important: This name musn't include any spaces and special characters. It serves as function recognition in the method calculation.
- Variable — Y axe variable
- Einheit — Y axe unit, for information
- Color — Curve and hystogram color
- Line width — Line width of the curve and the hystogram
- Script window — Text window for edit function scripts.
- Calculated values — Number of values, Mean value, Classes, Minimum, maximum, standard deviation.
- Graphic window — Coordinate system with the hystogram and the Gauss bell shaped curve.

3.4.2. General Properties

- Horizontal, X axe — Variable, Unit, Minimum, Maximum
  Linear scale is given.
- Vertical, Y axe — Variable, Unit, Minimum, Maximum
  Linear scale is given.
- Background — Background color

3.4.3. Base lines

- Base lines — Color, pattern, line width
- Horizontal — Base value, view
- Vertical — Base value, view

3.4.4. Grid

- Grid — Color, pattern, line width
- Horizontal — Division, view
- Vertical — Division, view

3.4.5. Create, Copy, Delete

<Statistic><Add New Statistic>
A new statistic will be added with a new tab.
The statistic script contains the ***BraceCalc*** standard statistic.
BraceCalc chooses name, shortname, color and line width.

<Statistic><Copy Selected Statistic>
A copy of the selected statistic will be added with a new tab.
BraceCalc changes name and shortname to avoid ambiguous problems.

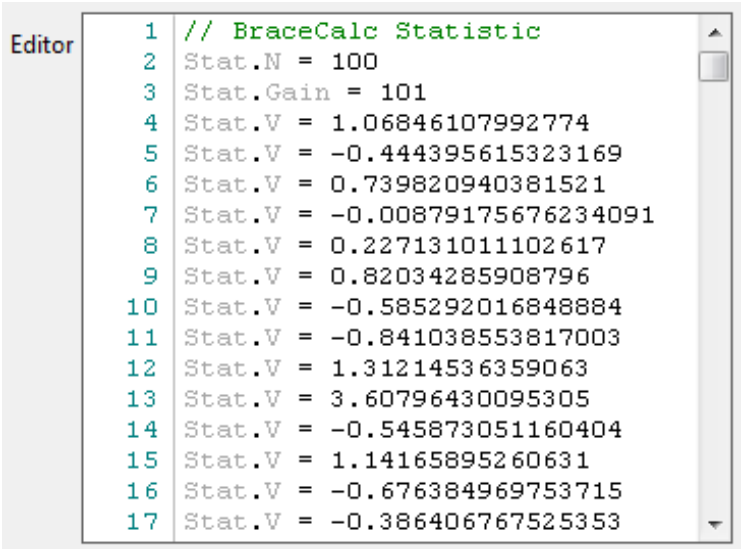
Important:
The statistic shortname has to be clear in the document.

<Statistic><Delete Selected Statistic>
The selected statistic will be deleted.

3.4.6. Create and Edit Scripts

You can edit the ***BraceCalc*** statistic scripts in the edit window of the statistic dialog.

It's possible to import and export the script text in text files.



Script key words are highlighted.

3.4.7. Parse and Calculate

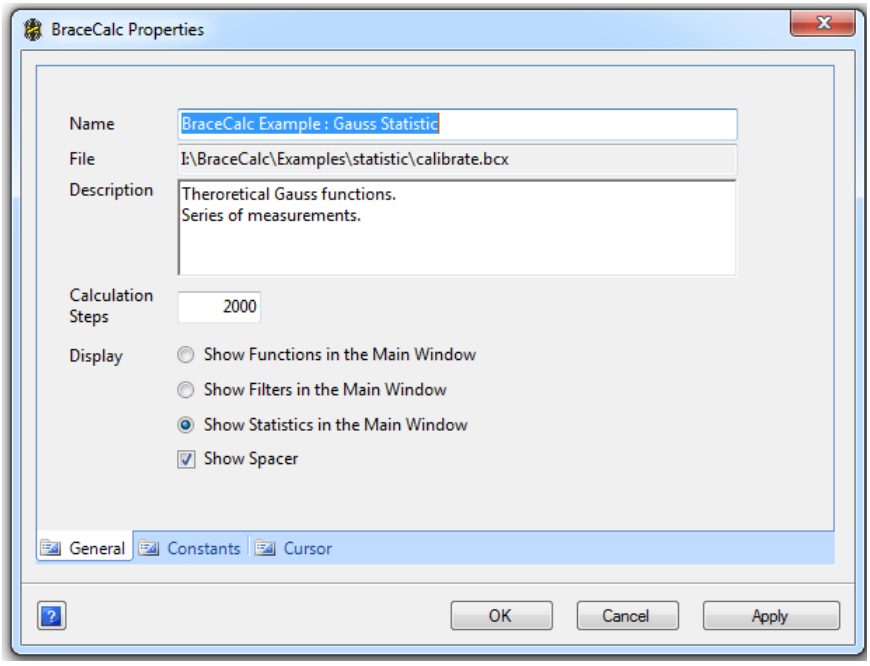
<Edit><Parse and Calculate> or Key<F5>
It's necessary to parse and calculate the statistics after changing.

All statistic scripts of the document will be reading and parsing.
After that all statistics will be calculated and displayed.

3.5. File Properties

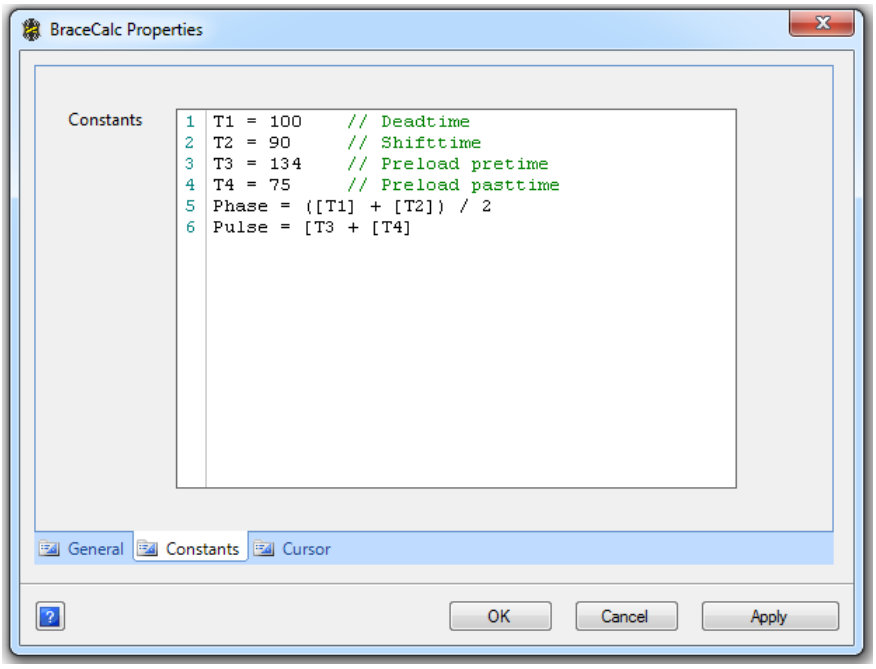
BraceCalc file properties are valid for every function, filter and statistic in the file.
These parameters are defined in the property dialog and can be different from other files.

3.5.1. General



Name	File title, name, for information.
File	File name and path of the actual file.
Description	Own text for information.
Calculation steps	Number of calculation steps for function, filter, statistic.
Main View	Function curves in the main view. Bode curves in the main view. Hystograms in the main view. With or without ruler view.

3.5.2. Constants

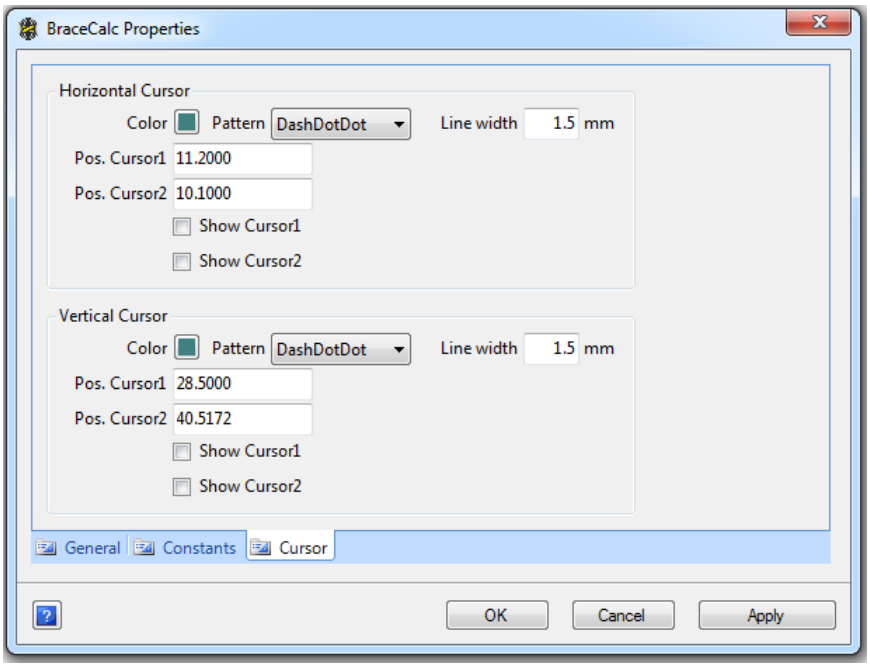


Define your own constants for the file. They will be valid for every function, filter and statistic in the file.

A constant is a real number or an algebraic expression.

3.5.3. Cursor

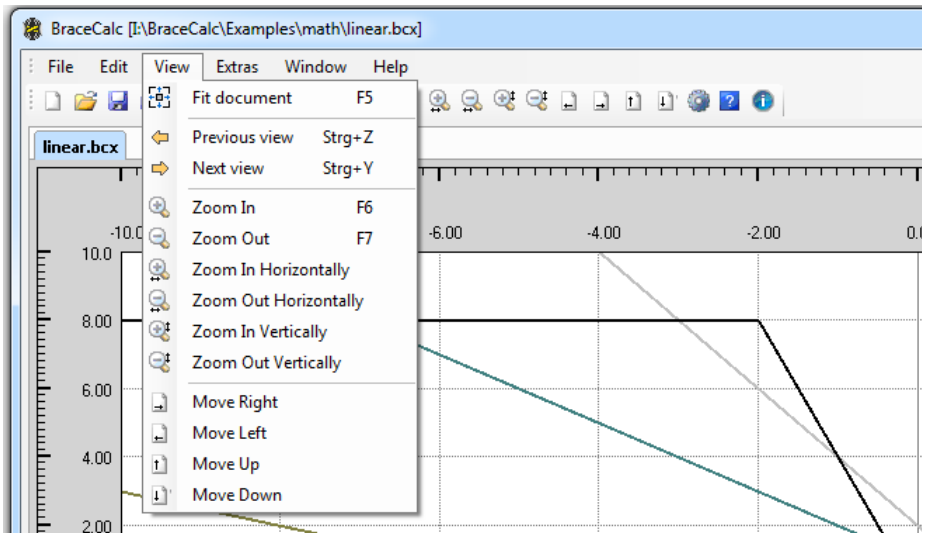
You can measure points and distances with four cursors within the main view.
The two horizontal cursors and the two vertical cursors can be displayed seperately.



- Color — Color of the horzontal cursors
- Pattern — Line pattern of the horizontal cursors
- Line width — Line width of the horizontal cursors
- Pos. Cursor 1 — Position of the first horizontal cursor
- Pos. Cursor 2 — Position of the second horizontal cursor
- Show Cursor 1 — Display the first horizontal cursor
- Show Cursor 2 — Display the second horizontal cursor
-
- Color — Color of the vertical cursors
- Pattern — Line pattern of the vertical cursors
- Line width — Line width of the vertical cursors
- Pos. Cursor 1 — Position of the first vertical cursor
- Pos. Cursor 2 — Position of the second vertical cursor
- Show Cursor 1 — Display the first vertical cursor
- Show Cursor 2 — Display the second vertical cursor

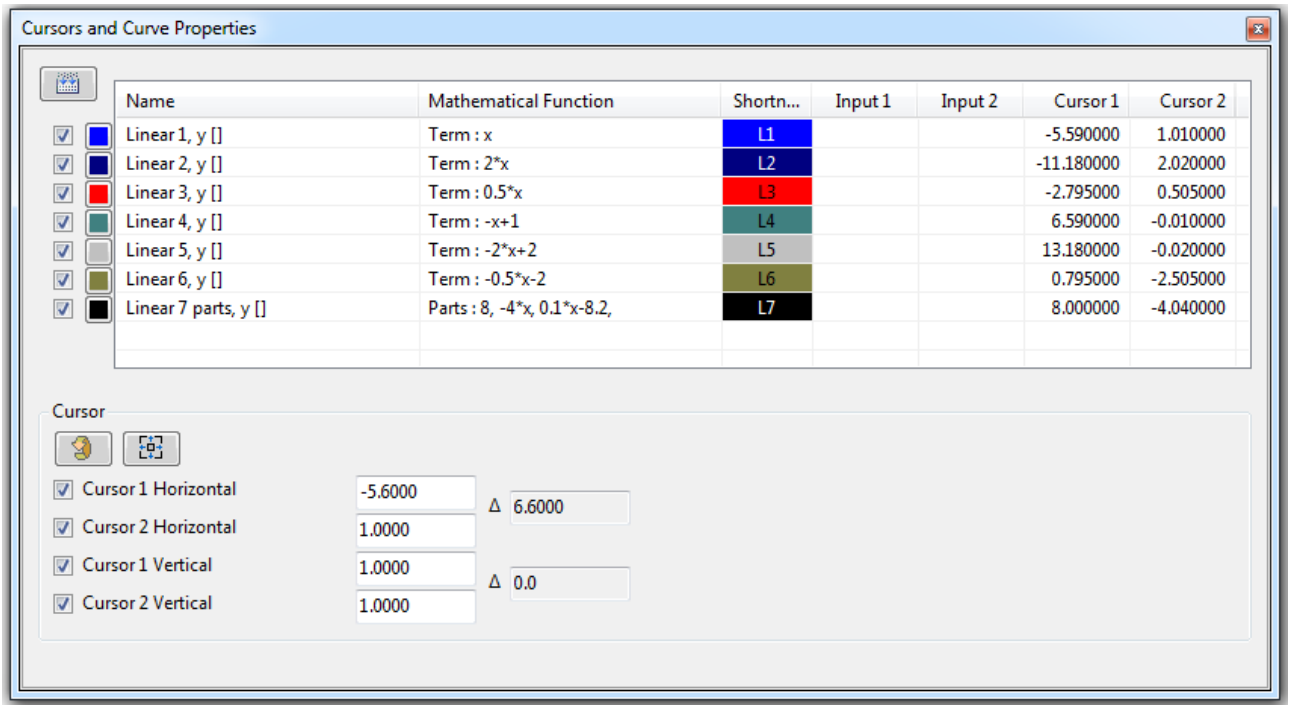
3.6. Main View

The ***BraceCalc*** main view can be adapted individually.



- Fit document [F5] Property view limits
- Previous view [Strg + Z]
- Next view [Strg + Y]
- Zoom In [F6] [Strg + Mousewheel down]
- Zoom out [F7] [Strg + Mousewheel up]
- Zoom In horizontal [H + Mousewheel down]
- Zoom Out horizontal [H + Mousewheel up]
- Zoom In vertical [G + Mousewheel down]
- Zoom Out vertical [G + Mousewheel up]
- Move Right [Shift + Mousewheel down]
- Move Left [Shift + Mousewheel up]
- Move Up [Mousewheel up]
- Move Down [Mousewheel down]

3.7. Cursors und Curve Properties



This panel shows all curves and cursors from the main view. You can display all curves individually.
Cuve informations are showed in the list. You can edit directly the function with a click on the color button.

You can display the cursors individally. You can also set a cursor position manually.

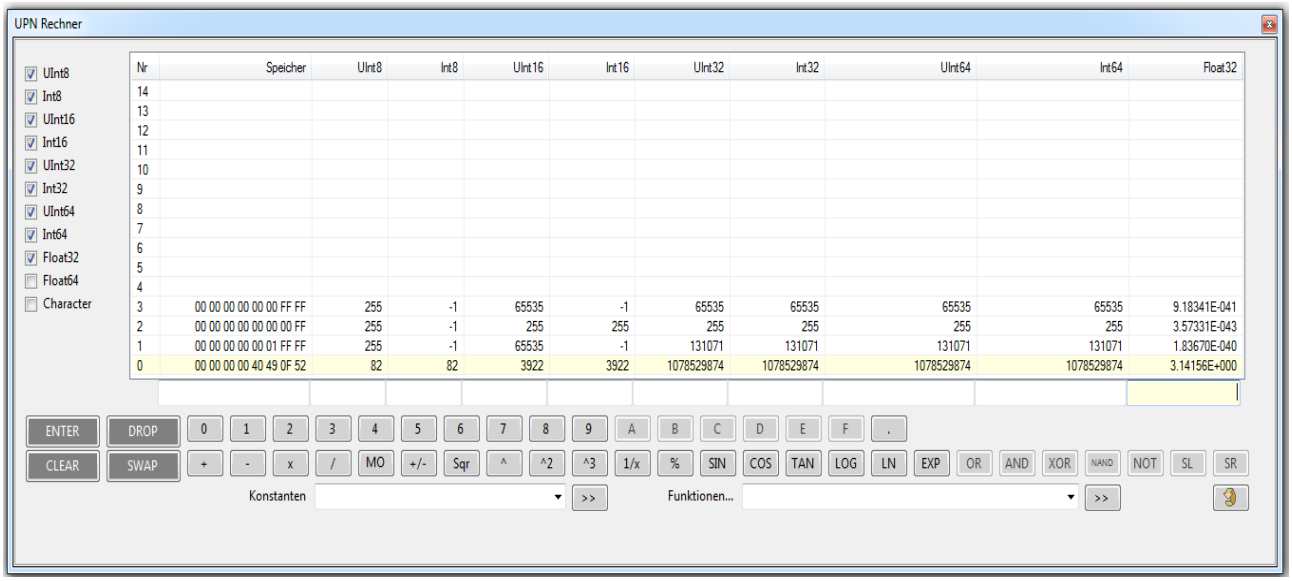
The active horizontal cursors shows also the intersection with a curve.

3.8. Calculator

A ***BraceCalc*** extra is a calculator with many possibilities.
The princip of the use is UPN(reverse polnish notation). This princip contains the most pocket calculators of HP (there's no further explanation about UPN).
The calculator has a 14 line width stack for types up to 64 bit.

• Memory	8Byte (64Bit) display in HEX	0..#FF FF FF FF FF FF FF FF
• Uint8	1Byte (8Bit) unsigned	0..255
• Int8	1Byte (8Bit) signed	-128..127
• Uint16	2Byte (16Bit) unsigned	0..65'535
• Int16	2Byte (16Bit) signed	-32'768..32'767
• Uint32	4Byte (32Bit) unsigned	0..4'294'967'295
• Int32	4Byte (32Bit) signed	-2'147'483'648..2'147'483'647
• Uint64	8Byte (64Bit) unsigned	0..1'844 E16
• Int64	8Byte (64Bit) signed	-922 E16.. 922 E16
• Float32	4Byte (32Bit) signed floating point	-3.402 E38..3.402 E38
• Float64	8Byte (64Bit) signed floating Point	-1.797 E308..1.797 E308
• Character	2Byte (16Bit) character	unicode charset

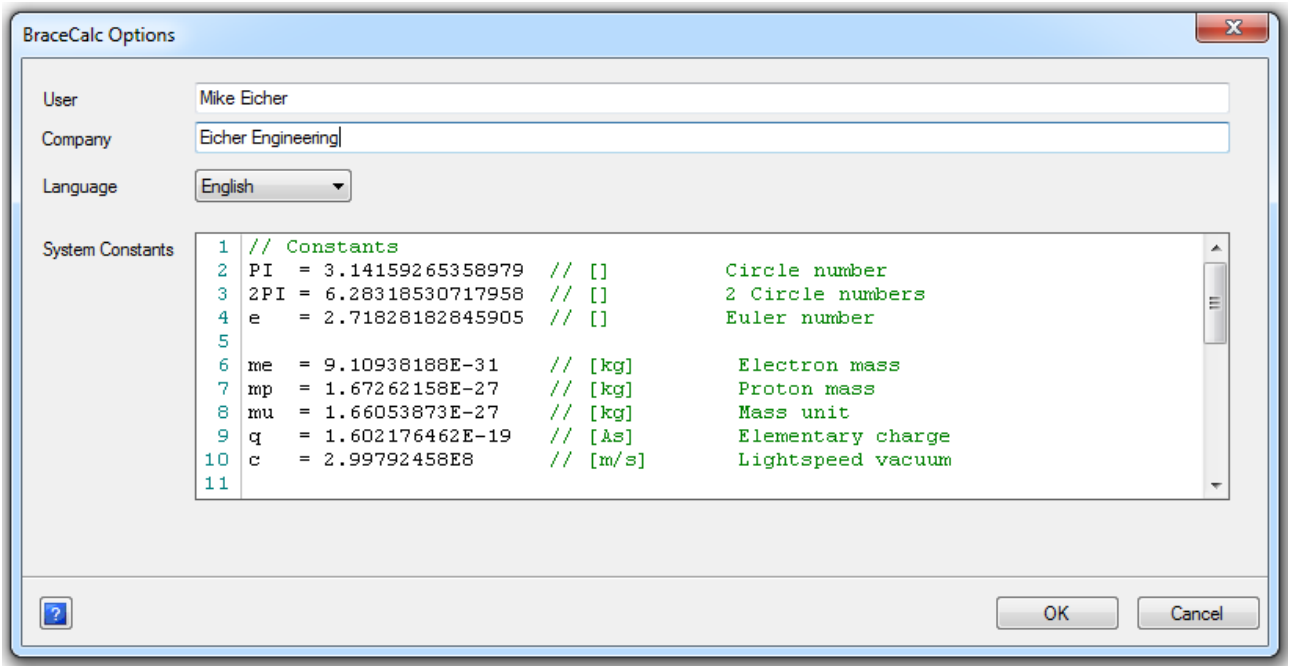
It depends in which format the value is written. It will convert in every other type format.
The memory row shows the exact mapping of the value in HEX format.



You can use basic arithmetic operations and the consts and mathemtical terms from the application in the calculator. You also can define own consts and terms for calculating.

- ENTER The entere value will copy to the stack line 0 and convert.
- DROP Stack line 0 will deleted and the stack shifts one line down.
- CLEAR The entire stack will deleted.
- SWAP Stack line 0 und Stack line 1 will swaped.

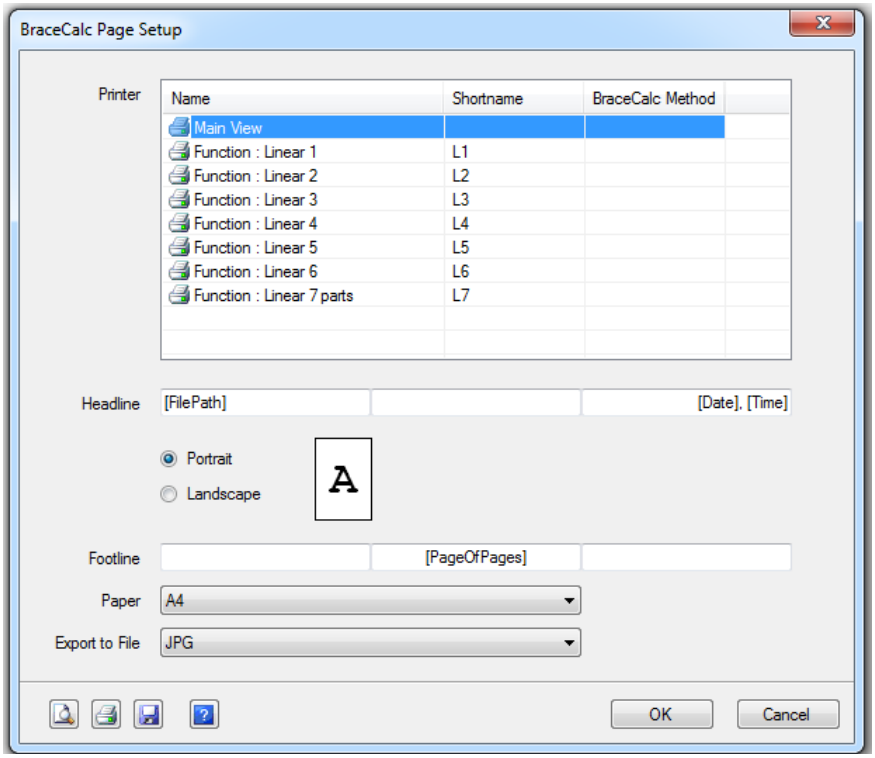
3.9. Options



- User — Username for information.
- Company — Company name for information.
- Language — ***BraceCalc*** Language.
  German
  English
- System Constants — These constants are valid in the enitre ***BraceCalc*** program.

3.10. Print

BraceCalc offers a bunch possibilities for printing, preview and export data.



- Printer — You can print every defined function, filter and statistic on a single or multiple print.

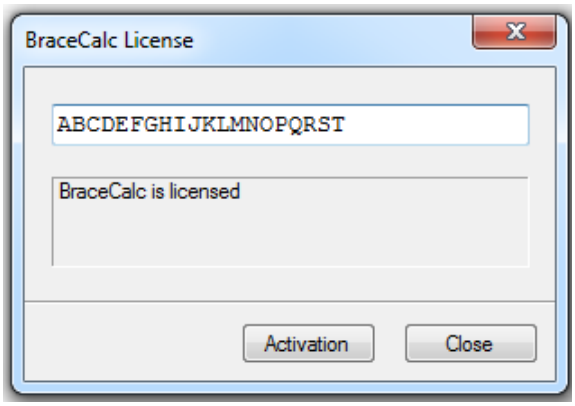
- Headline, Footline — These lines are subdivided in left, middle and right. You can enter normal text or a predefinied fields.

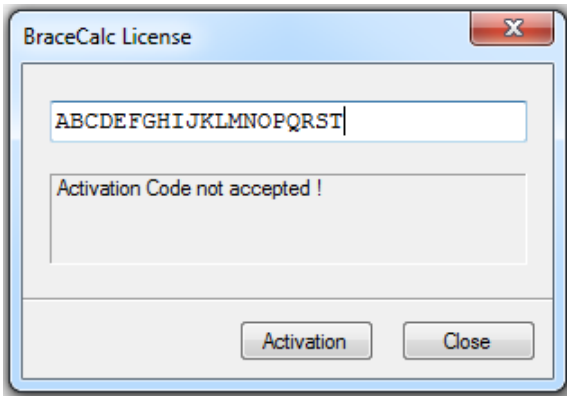
[FileName]	Filename without path
[FilePath]	Filename with entire path
[Page]	Page number
[Pages]	Number of pages
[PageOfPages]	Page of pages
[Date]	Date
[Time]	Time

- Format — Portrait or Landscape
- Paper — Choice of paper size
- File export — Export to a file
  - JPEG
  - BMP
  - PDF
  - GIF
  - TIFF
  - PNG

3.11. License

You can use ***BraceCalc*** without any restrictions with a valid license key.





You cannot save or print any ***BraceCalc*** data without a valid license key.

Please read the licensing agreement.

3.12. Help

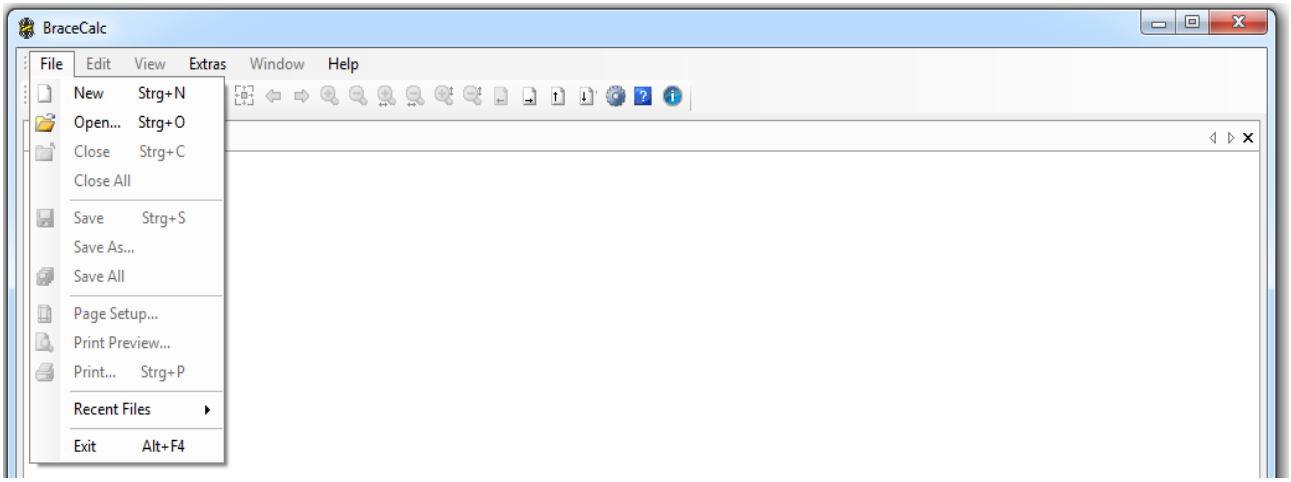
This PDF documentation is the user manual and the help file.
You can also get these documentation files from the Eicher Engineering home page http://www.eichereng.ch.

4. Tutorial

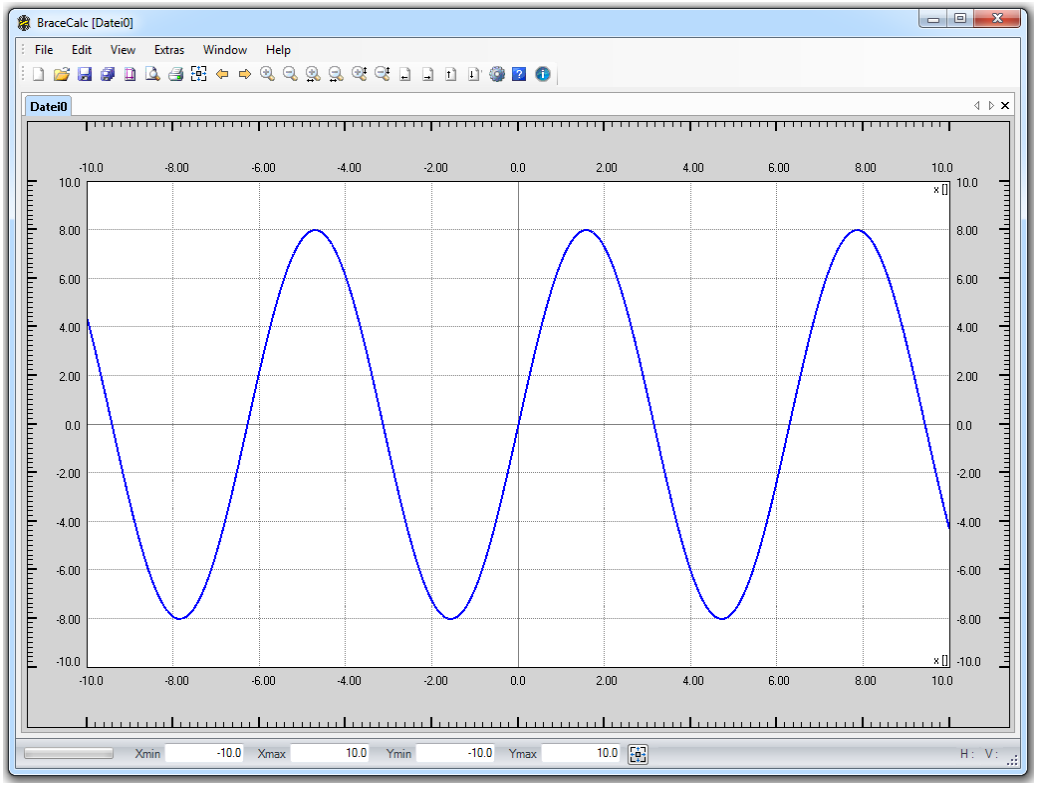
Following tutorial describes the definition of a sinus curve which will modulated with a PWM (Pulse Wide Modulation) signal and then filtered with a RLC (Resistor, Impedance, Capacity) circuit.

4.1. New File

<New> oder <Strg+O>



BraceCalc creates a new document with the standard function.

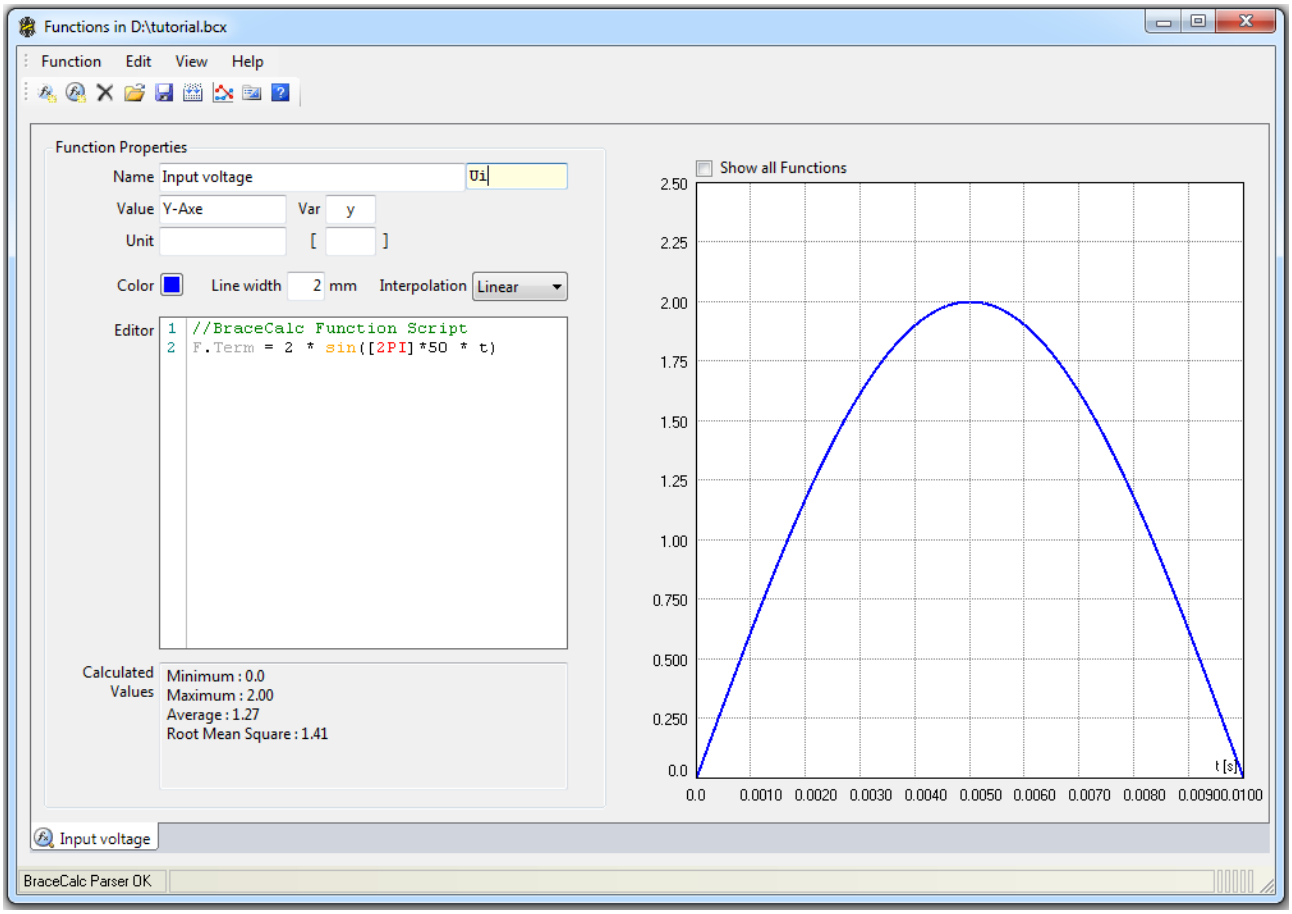


Save the document (BCX file) with an own name and place.

<Save as...>

4.2. Function half wave sinus

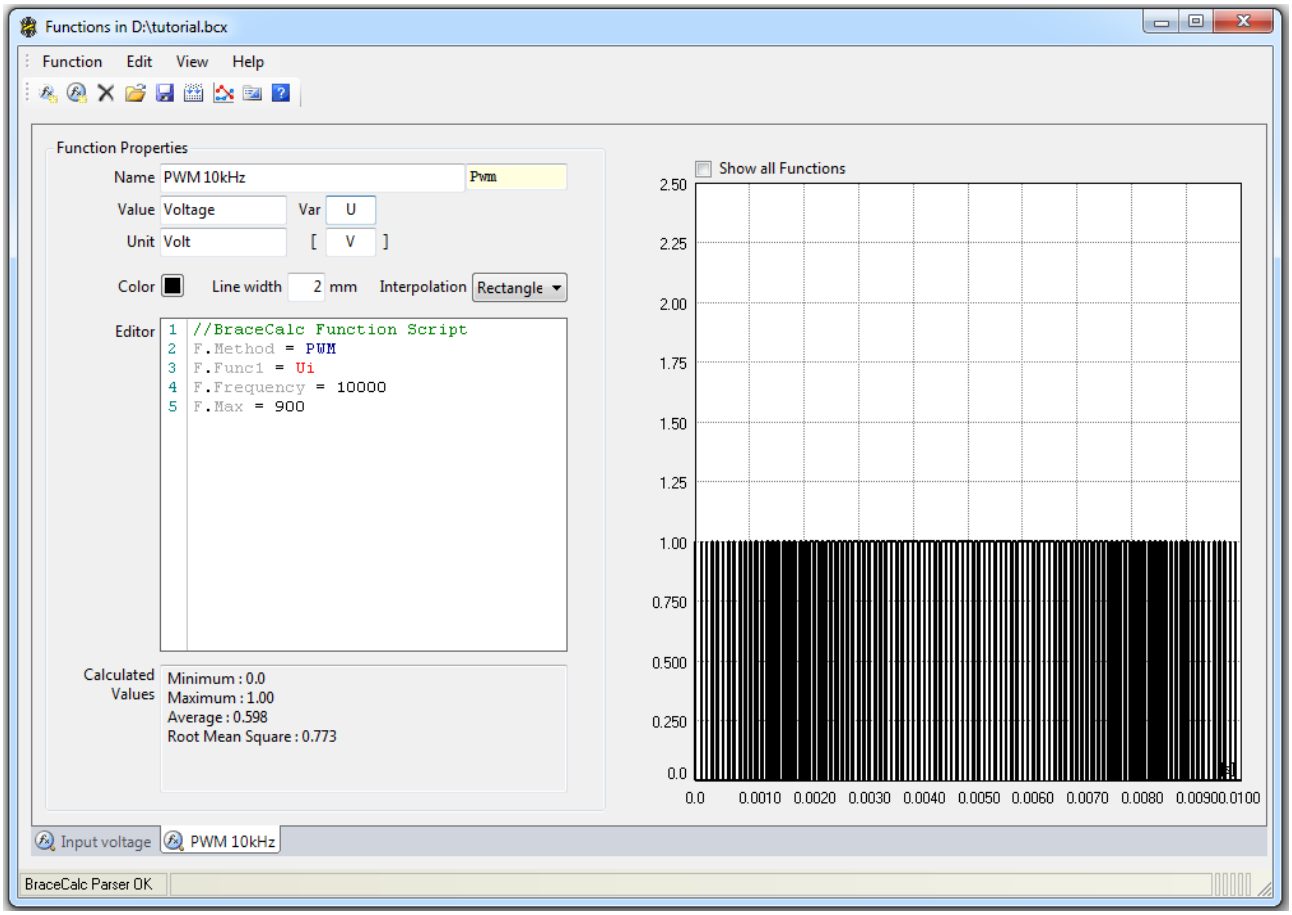
Switch to the function dialog.
Change the function parameters and the script as below for a half wave sinus 50Hz, 2Volts.



The const [2PI] is a system constant and already defined.

4.3. Method PWM

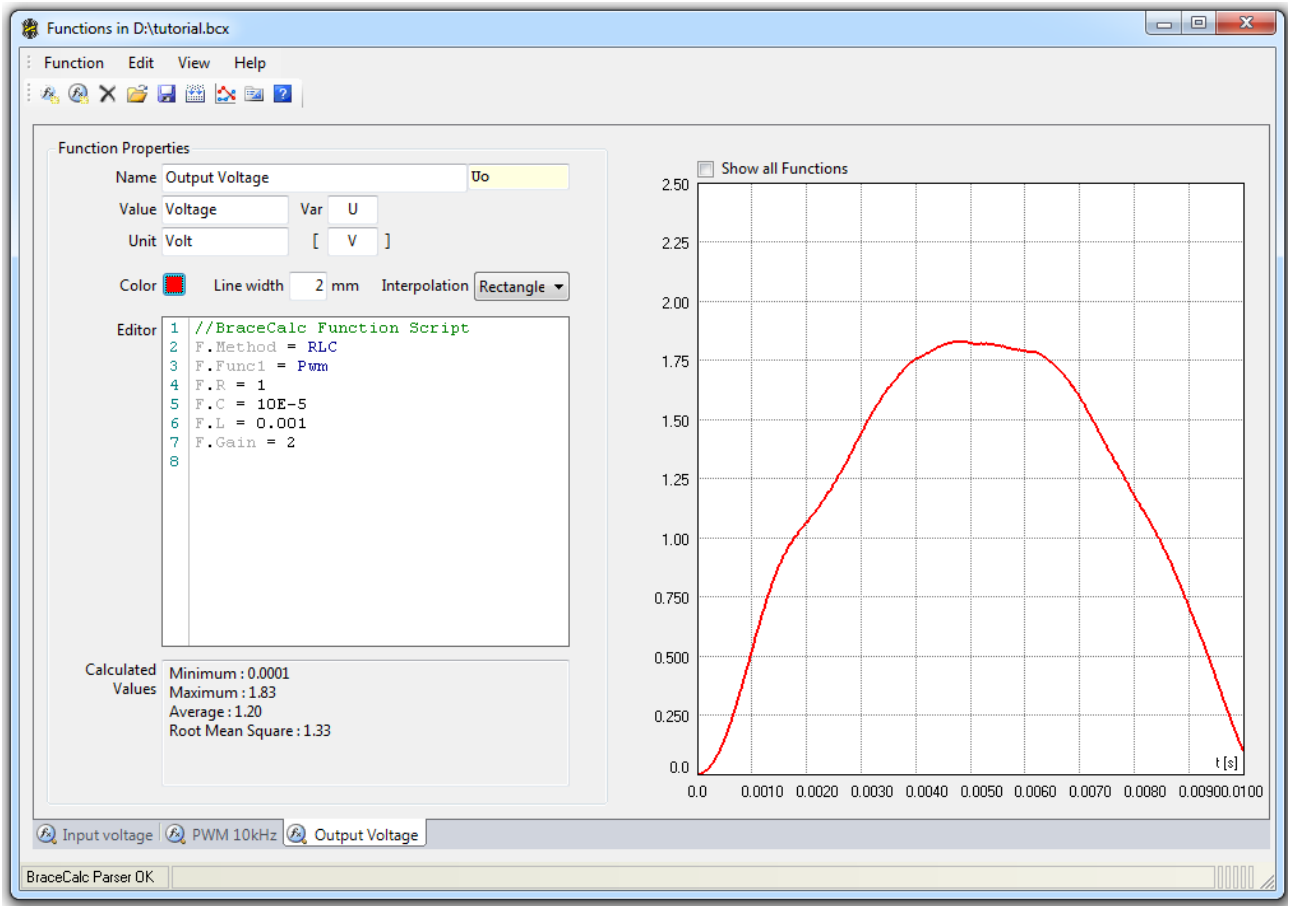
Create a new function which calculates a 20kHz PWM signal based on the sinus function above. The maximum duty cycle is 90%.



4.4. Method RLC

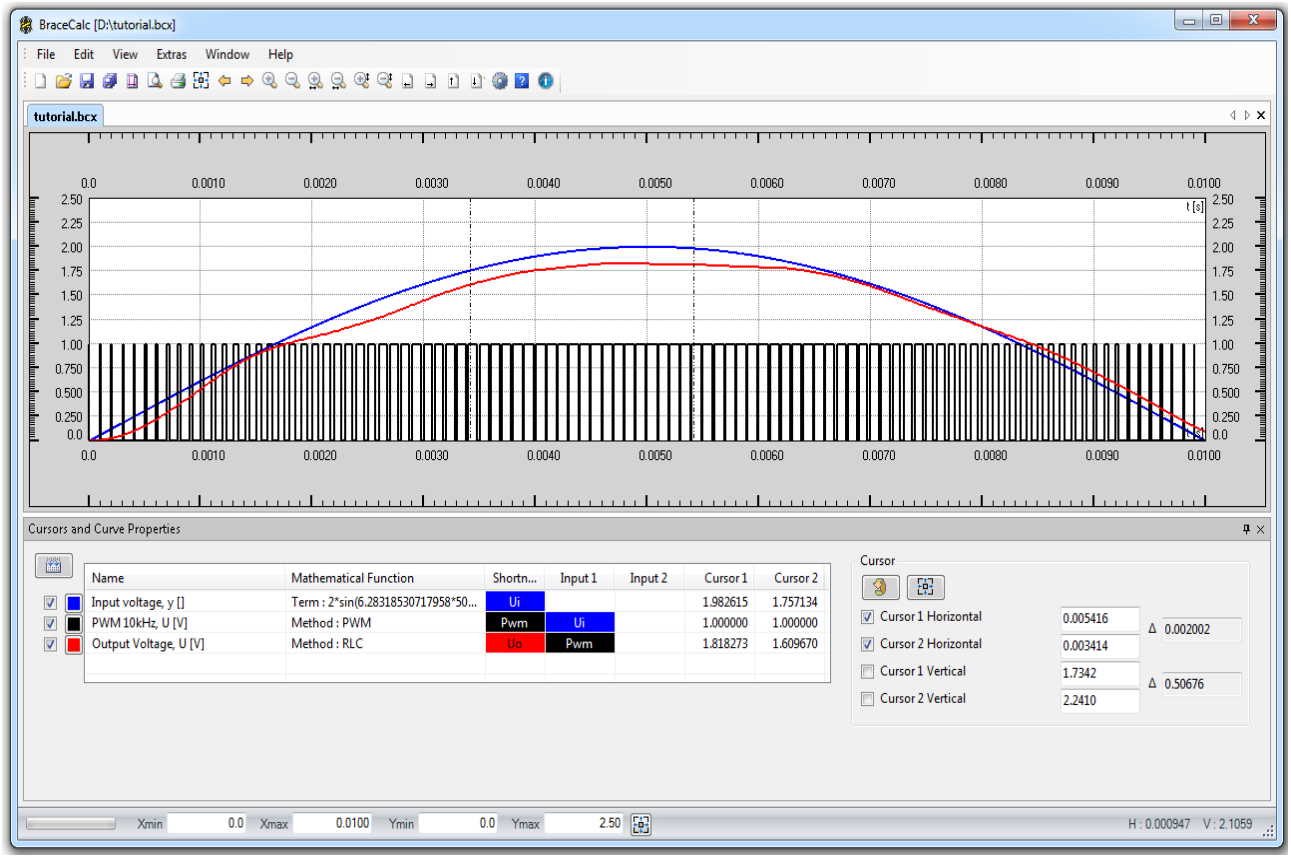
Create a new function which calculates a filtered function based on the PWM signal above and a RLC circuit.

R = 1Ω
L = 1mH
C = 100µF
Gain = 2



You can display the frequency spectrum to see the generated harmonics of the output function.

4.5. Main view



Now you see all three function (singals) on the screen. You also recognize the phae shift betwenn input signal and output singal.

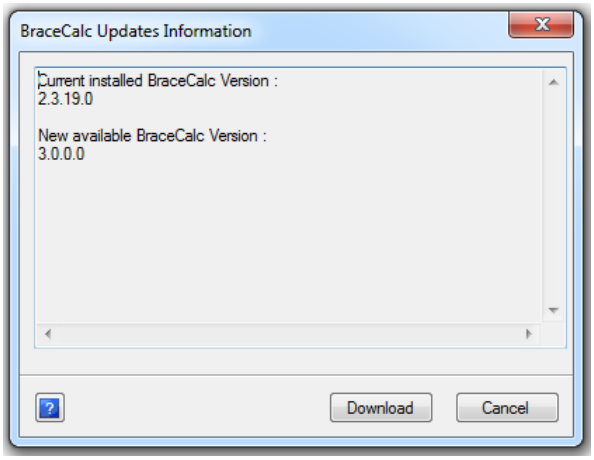
The curve and cursor panel shows you the link between the function methods. Methodenverknüpfungen.

You find this tutorial as the ***BraceCalc*** file tutorial.bcx.

5. Updates

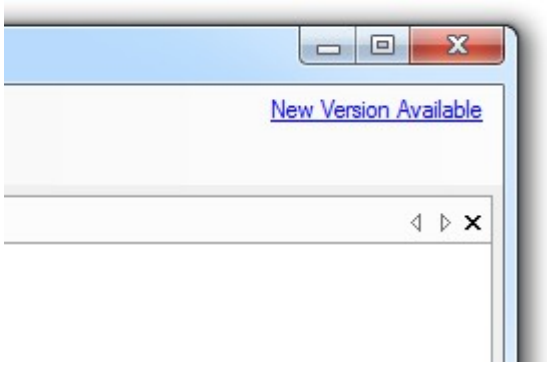
New ***BraceCalc*** versions could be downloaded from the internet.

<Help><Search for Updates...>



First you have to save all not saved documents in the application before you can download the update.

During the application start, ***BraceCalc*** is searching for new versions over the internet automatically. It displays any founds on the right upper corner.



6. Appendix